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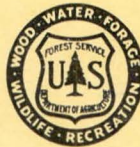
UNITED STATES DEPARTMENT OF AGRICULTURE
FOREST SERVICE

CUMBERLAND NATIONAL FOREST

REGION 7

TIMBER MANAGEMENT PLAN

1966 - 1975



CUMBERLAND NATIONAL FOREST

REGION 7

F.Y. 1966 - 1975

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Plans
Timber Management

CUMBERLAND NATIONAL FOREST

TIMBER MANAGEMENT PLAN

Jointly Submitted

July 2, 1965

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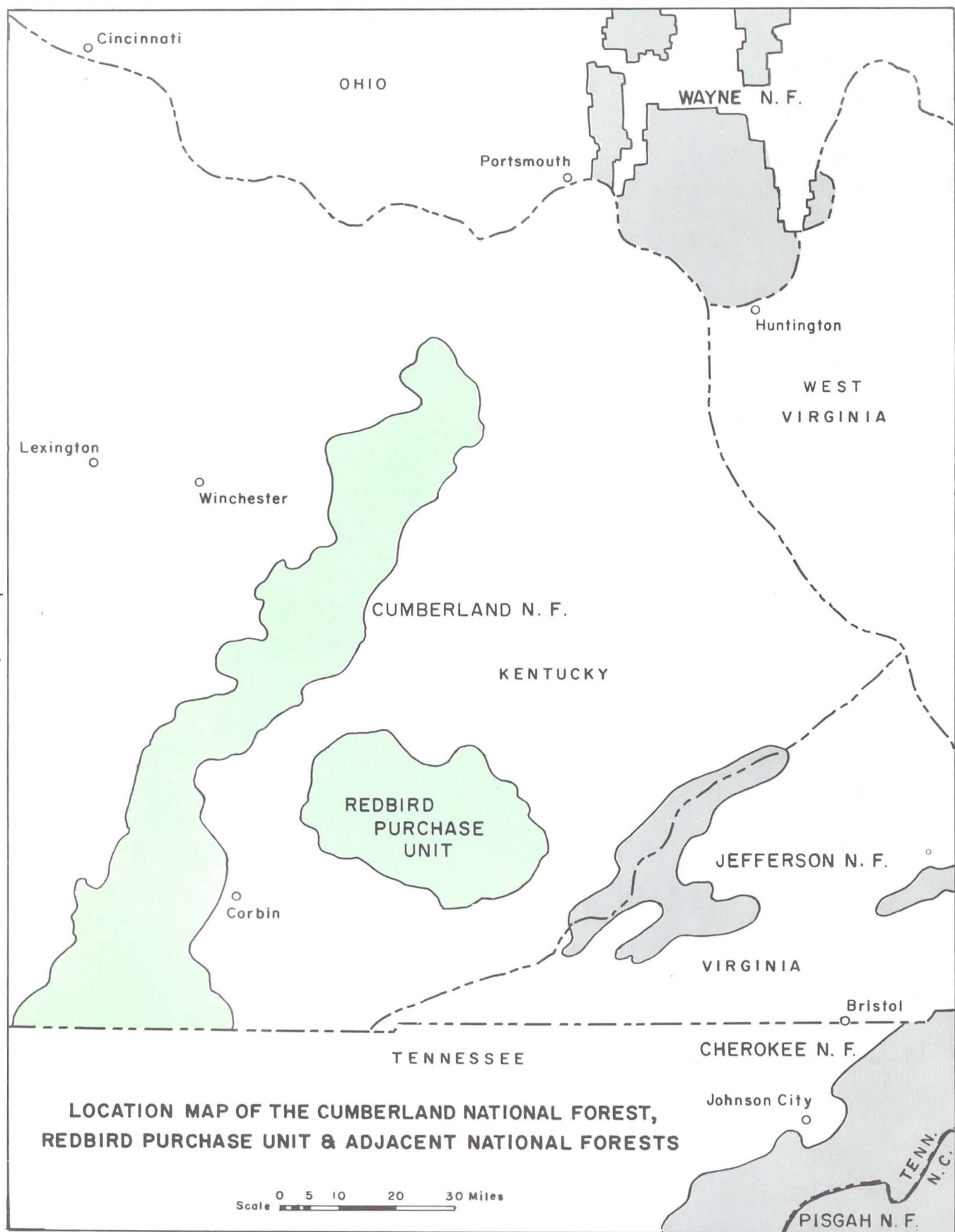
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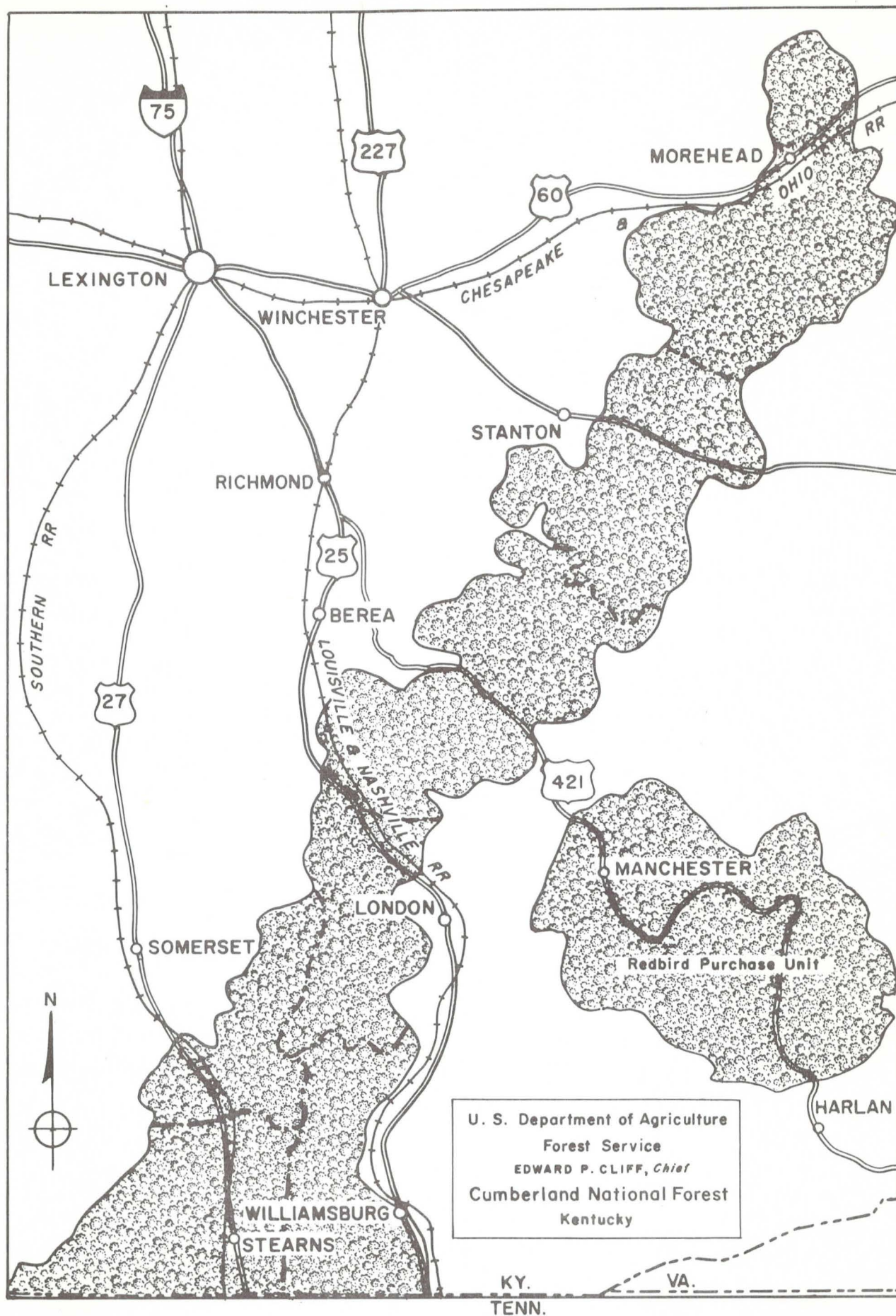
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PREFACE

This Timber Management Plan treats the entire Cumberland National Forest as one working circle. It supersedes all previous plans. The Plan is for ten years, F. Y. 1966 - 1975, and will be revised in 1975.

The Forest is divided into seven Ranger Districts, or blocks. The various statistical tables included in the Plan are those needed to regulate programs for the entire working circle, except for tables used to regulate operations by blocks.

The inventory and computations were a cooperative project with the Lake States and Northeastern Forest Experiment Stations. The Forest Inventory was fully integrated with the Forest Survey's Timber Resource Survey of Kentucky. The Resource Report of Kentucky is presently being prepared by the Central States Forest Experiment Station. The Forest Inventory is based on sampling areas stratified by volume classes on 1959 - 1960 aerial photographs. Growth was based on a remeasurement of 154 plots randomly selected from the 350 initially established in 1956. Area condition acreage was obtained through the remeasurement of the 154 plots, plus the field examination of 170 of the Forest's 768 compartments.

A coordination section is included in this Plan for the purpose of defining the ways and means by which the even-aged system of management has been adapted and modified to secure compatibility with the concurrent management objectives of all the resources of the Cumberland National Forest under the principles of multiple-use-sustained yield management. The Regional Multiple-Use Management Guides and the Ranger District plans provide the policy and basis for coordinating the resource programs and instructions. This Plan has been based on these policy guidelines.

This Plan was prepared by Staff Officer Alan R. Duhnkrack and Staff Forester Peace for the approval of the reviewing authorities. The advice and assistance of other forest and Regional Office staff is appreciatively acknowledged.

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II - APPENDIX

GROWTH DATA FROM REMEASURED PLOTS

A. SUMMARY OF PLAN

1. Area

<u>District (Block)</u>	<u>FOREST ACREAGE</u> ^{1/} (Thousand Acres)		<u>Non-forest</u>	<u>Total</u>
	<u>Commercial Forest Land</u>	<u>Productive Reserved Forest Land</u>		
Morehead	79.5		1.4	80.9
Stanton	50.9		.5	51.4
Berea	68.0		.8	68.8
Somerset	62.2		1.7	63.9
London	50.1 ^{2/}	.2 ^{3/}	.8	51.1
Stearns	98.0		1.7	99.7
Williamsburg	44.2		.6	44.8
Total	452.9	.2	7.5	460.6

1/ National Forest Acreage Summary - June, 1964

2/ Includes 3,460 acres in the Bald Rock Experimental Forest. This area of commercial forest land is in an unregulated classification.

3/ Rock Creek Natural Area

2. Volume

VOLUME OF TIMBER ON COMMERCIAL FOREST LAND BY CLASS OF TIMBER AND BY DISTRICTS

: C L A S S O F T I M B E R :					
: District: Poletimber 1/: Sawtimber 9 & 10" + 1/ : Sawtimber :					
(Block) : (5-9", 11" DBH): Sawlogs Upper Stem 1/ Total : 9" & 11" + DBH					
: - - - - - MM Cu. Ft. - - - - - : MM Bd. Ft.					
Morehead:	27.8	44.8	10.2	82.8	: 204.3
Stanton :	20.3	37.9	7.4	65.6	: 167.8
Berea :	29.1	37.6	8.4	75.1	: 170.4
Somerset:	22.4	41.2	7.7	71.3	: 176.5
London :	17.8	34.4	6.1	58.3	: 146.6
Stearns :	37.2	65.8	11.9	114.9	: 279.8
Williams:	15.4	33.7	6.1	55.2	: 145.0
burg :					
Forest :	170.0	295.4	57.8	523.2	: 1,290.4

Conversation Units (approximate):

1 cu. ft. = 3.34 bd. ft. (Includes upper stem portion of sawtimber trees)

1 cu. ft. = 4.37 bd. ft. (Sawlog merchantable heights only)

80 cu. ft. = 1 rough cord (4x4x8)

1/ Minimum top 4" d.i.b.

3. Average Net Annual Periodic Growth (Commercial Forest)

	<u>Total (M)</u>		<u>Per Acre</u>	
	<u>Cu. ft.</u>	<u>Bd. ft.</u>	<u>Cu. ft.</u>	<u>Bd. ft.</u>
Growing Stock <u>1/</u>	13,859		30.6	
Sawtimber, Hardwood	5,275	23,052		
Softwood	3,513	15,353		
Total Sawtimber	8,788	38,405	19.4	84.8

1/ All trees 5" plus DBH - including sawtimber

4. Regulation

- a. By area with volume check
- b. Cutting cycle - 10 years
- c. Rotation - 100 years 1/

1/ Silvicultural rotations vary with stand type and site.
See Section D-2.

5. Annual Periodic Allowable Cut - F.Y. 1966 to F.Y. 1975
(Based on area control with volume check)

The allowable cut is based on area control. Each year, the Forest Supervisor will allot allowable cut acreage by Ranger Districts to assure that a total of 180,000 acres will be treated by commercial sawtimber sales during the Plan period. The amount of additional acreage treated by product sales will depend on market conditions.

Cutting Method	Inter- mediate	Regeneration			Total
		Stand	Shelterwood or	Seed Tree	
			Preparatory or Seed	Removal	
Regulated area to examine -(Acres)					45,290
Estimated Area to cut -(Acres) ^{1/}	13,470	2,280	1,850	400	18,000
Estimated yield: Sawtimber (MMBF)	19.1	8.0	9.9	1.0	38.0
Unregulated addi- tional ^{1/} cut objective (M Cds.)	34.0	6.0	2.8	0.7	43.5 ^{2/}

^{1/} Refer to Table 6, Appendix, for acres by Treatment and Area Condition Classes.

^{2/} Includes 4,000 cords of topwood from sawtimber trees

Present product market conditions will limit the volume of products sold annually to 15,000 cords. The primary source of this material should be from intermediate treatments made in pole-size and two-storied stands. An additional 28,500 cords could be sold annually from the 18,000 acres to be treated by commercial sawtimber sales if access was provided and markets developed.

PERIODIC TIMBER MANAGEMENT PLANNING REPORT

REGION [2-3] <u>0 7</u>	FOREST [4-5] <u>0 3</u>	WORKING CIRCLE [6] Cumberland <u>1</u>
CLASS [7] <u>1</u>	STATE [8-9] <u>1 6</u>	INVENTORY YEAR [10-11] <u>6 3</u>

NET INVENTORY AND NET PERIODIC ANNUAL GROWTH ON NONRESERVED COMMERCIAL NATIONAL FOREST LAND

BLOCK A-CARD CODE 1		SAWTIMBER [12-17]	OTHER PRODUCTS [30-34]	GROWING STOCK [35-40]
	1. INVENTORY: a. Local Scale (100 MBF)	<u>0 0 4 5 0 7</u>		
	b. Int. 1/4" Rule (100 MBF)	<u>0 0 4 5 0 7</u>		
	c. Cubic Measure (100 MCF)	<u>0 0 1 1 9 0</u>	<u>0 0 3 7 7</u>	<u>0 0 1 5 6 7</u>
	d. Stocked Measure (100 Cds.)		<u>0 4 7 1 5</u>	
	2. NET GROWTH: a. Local Scale (100 MBF)	<u>0 0 1 5 4</u>		
	b. Cubic Measure (100 MCF)	<u>0 0 0 3 5</u>	<u>0 0 1 6</u>	<u>0 0 0 5 1</u>
	3. MORTALITY: Cubic Measure (100 MCF)	<u>0 0 0 0 0</u>	<u>0 0 0 0</u>	<u>0 0 0 0 0</u>

AREA AND INVENTORY ON PRODUCTIVE RESERVED AND COMMERCIAL NATIONAL FOREST LAND

BLOCK B-CARD CODE 2		PRODUCTIVE RESERVED [12-16]	UNREGULATED [17-21]	MODIFIED LANDSCAPE [22-26]	NON-MODIFIED [27-32]
	1. AREA (100 Acres)	<u>0 0 0 0 0</u>	<u>0 0 0 0 0</u>	<u>0 0 0 0 0</u>	<u>0 0 0 3 5 6</u>
	2. SAWTIMBER (100 MBF)	<u>0 0 0 0 0</u>	<u>0 0 0 0 0</u>	<u>0 0 0 0 0</u>	<u>0 0 4 5 0 7</u>
	3. GROWING STOCK (100 MCF)	<u>0 0 0 0 0</u>	<u>0 0 0 0 0</u>	<u>0 0 0 0 0</u>	<u>0 0 1 5 6 7</u>
	4. OPTIONAL SPACE	SPECIFY [75-77]	<u>0 0 0</u>	SPECIFY [78-80]	<u>0 0 0</u>

REGULATED ALLOWABLE ANNUAL CUT AND UNREGULATED MATERIAL AVAILABLE ANNUALLY

BLOCK C-CARD CODE 3		AREA (100 Acres) [12-15]	SAWTIMBER (100 MBF) [16-19]	OTHER PROD. (100 CDS) [20-23]
	1. INTERMEDIATE	<u>0 0 1 1</u>	<u>0 0 6 7</u>	<u>0 0 0 0</u>
	2. SALVAGE	<u>0 0 0</u>	<u>0 0 0</u>	<u>0 0 0</u>
	3. REGENERATION			
	a. Group, Patch, Strip, Stand	<u>0 0 2</u>	<u>0 0 2 8</u>	<u>0 0 0 0</u>
	b. Shelterwood, Seedtree			
	(1) Preparatory, Seed	<u>0 0 2</u>	<u>0 3 5</u>	<u>0 0 0</u>
	(2) Removal	<u>0 0 1</u>	<u>0 0 4</u>	<u>0 0 0</u>
	c. Selection	<u>0 0 0</u>	<u>0 0 0</u>	<u>0 0 0</u>
	4. UNREGULATED		<u>0 0 0 0</u>	<u>0 1 5 0</u>

PREPARED	DATE	SIGNATURE	TITLE
AUDITED	DATE	SIGNATURE	TITLE

PERIODIC TIMBER MANAGEMENT PLANNING REPORT

REGION [2-3]	FOREST [4-5]	WORKING CIRCLE [6]
0 7	0 3	Cumberland 1
CLASS [7]	STATE [8-9]	INVENTORY YEAR [10-11]
2	1 6	6 3

NET INVENTORY AND NET PERIODIC ANNUAL GROWTH ON NONRESERVED COMMERCIAL NATIONAL FOREST LAND

BLOCK A--CARD CODE 1		SAWTIMBER	OTHER PRODUCTS	GROWING STOCK
		[12-17]		
	1. INVENTORY: a. Local Scale (100 MBF)	0 0 8 3 9 7		
		[18-23]		
	b. Int. 1/4" Rule (100 MBF)	0 0 8 3 9 7		
		[24-29]	[30-34]	[35-40]
	c. Cubic Measure (100 MCF)	1 7 6 5	0 1 9 0 1	0 0 3 6 6 6
			[41-45]	
	d. Stocked Measure (100 Cds.)		2 3 7 6 2	
		[46-50]		
	2. NET GROWTH: a. Local Scale (100 MBF)	0 0 2 3 1		
		[51-55]	[56-59]	[60-64]
	b. Cubic Measure (100 MCF)	0 0 0 5 3	0 0 3 4	0 0 0 8 7
		[65-69]	[70-73]	[74-78]
	3. MORTALITY: Cubic Measure (100 MCF)	0 0 0 0 1	0 0 0 1	0 0 0 0 2

AREA AND INVENTORY ON PRODUCTIVE RESERVED AND COMMERCIAL NATIONAL FOREST LAND

BLOCK B--CARD CODE 2		PRODUCTIVE RESERVED	UNREGULATED	MODIFIED LANDSCAPE	NON-MODIFIED
		[12-16]	[17-21]	[22-26]	[27-32]
	1. AREA (100 Acres)	0 0 0 0 2	0 0 0 3 5	0 0 0 0 0	0 0 4 1 3 8
		[33-37]	[38-42]	[43-47]	[48-53]
	2. SAWTIMBER (100 MBF)	0 0 0 0 4	0 0 0 6 4	0 0 0 0 0	8 3 3 3
		[54-58]	[59-63]	[64-68]	[69-74]
	3. GROWING STOCK (100 MCF)	0 0 0 0 2	0 0 0 2 8	0 0 0 0 0	0 0 3 6 3 8
	4. OPTIONAL SPACE	SPECIFY	[75-77]	SPECIFY	[78-80]
			0 0 0		0 0 0

REGULATED ALLOWABLE ANNUAL CUT AND UNREGULATED MATERIAL AVAILABLE ANNUALLY

BLOCK C--CARD CODE 3		AREA (100 Acres)	SAWTIMBER (100 MBF)	OTHER PROD. (100 CDS)
		[12-15]	[16-19]	[20-23]
	1. INTERMEDIATE	0 1 2 4	0 1 2 4	0 0 0 0
		[24-26]	[27-29]	[30-32]
	2. SALVAGE	0 0 0	0 0 0	0 0 0
	3. REGENERATION			
		[33-35]	[36-39]	[40-43]
	a. Group, Patch, Strip, Stand	0 2 1	0 0 5 2	0 0 0 0
	b. Shelterwood, Seedtree			
		[44-46]	[47-49]	[50-52]
	(1) Preparatory, Seed	0 1 7	0 6 4	0 0 0
		[53-55]	[56-58]	[59-61]
	(2) Removal	0 0 3	0 0 6	0 0 0
		[62-64]	[65-67]	[68-70]
	c. Selection	0 0 0	0 0 0	0 0 0
			[71-74]	[75-78]
	4. UNREGULATED		0 0 0 0	0 2 8 5

PREPARED	DATE	SIGNATURE	TITLE
AUDITED	DATE	SIGNATURE	TITLE

B. HISTORY

1. Land Description

The Cumberland National Forest, consisting of 460,577 acres, is located in the Cumberland Plateau of the Eastern Kentucky Mountain Region. The Forest extends from the Tennessee line northward to a point 18 miles south of the Ohio River, covering a total length of 150 miles and averaging 12 miles in width.

The Plateau is severely dissected by the irregular drainage pattern of the three large rivers - the Licking, Kentucky, and Cumberland, all of which drain into the Ohio River. The elevations range from 500 feet to 2500 feet above sea level. The Forest area is broken by steep, narrow valleys, many containing abrupt cliff lines, which make some drainages rather inaccessible and creates problems in logging.

The Forest occupies parts of 17 counties which are: Rowan, Bath, Menifee, Morgan, Powell, Wolfe, Lee, Owsley, Estill, Jackson, Madison, Rockcastle, Pulaski, Laurel, Wayne, McCreary, and Whitley.

2. Past Accomplishments

a. Land Status

Approximately 3,500 acres were acquired since the 1957 Plan and Inventory. However, the acreage of commercial forest land is actually 14,900 acres more than the previous Plan. This is due to changes in land classification, with more accurate data in regard to land used by reservoir projects, roads, rights-of-way, etc.

The 3,460-acre Bald Rock Experimental Forest on the London District is classified as unregulated commercial forest land. The management situation and direction differ due to the specific management objectives established by enabling authorities in 1956. The allowable cut volumes calculated for the Forest do not include the potential cut from this area.

The Forest is now sub-divided into seven Ranger Districts. Each District is sub-divided into compartments (smallest permanent management unit),

with an average size of 600 acres and varying between 200 to 1000 acres, giving a total of 768 compartments for the Forest.

b. Volume and Area Cut Over

F.Y. Periods	Sawtimber	Products	Total	Annual Cut
	----- MM bd. ft. -----			
1936 - 1941	13.9		13.9	2.3
1942 - 1946	56.3		56.3	11.3
1947 - 1951	61.7		61.7	12.3
1952 - 1956	71.4	2.1*	73.5	14.7
1957 - 1961	90.9	8.2	99.1	19.8
1962 - 1964	56.5	9.2	65.7	21.9
Total 29-Year Period	350.7	19.5 ^{1/}	370.2	
Average/Year	12.1	2.2 ^{1/}	12.8	
Allowable Cut Previous Plan				
Annual	24.9	13.5	38.4	
Total ^{2/}	174.3	94.5	268.3	114.8 M Acres
Actual Cut Previous Plan				
Annual	18.8	2.3	21.1	
Total ^{2/}	131.6	16.1	147.7	73.9 M ^{3/} Acres

*Products sold during F.Y. 1956. Prior to F.Y. 1956 almost all of the cut volume came from sawtimber.

1/ 9-year period

2/ F.Y. 1958 - 1964

3/ 18.5 M regeneration acreage

c. Timber Stand Improvement and Reforestation

During the period F.Y. 1957 through F.Y. 1964, the following acreage received timber stand improvement and reforestation treatments:

<u>Treatment</u>	<u>P&M</u>	<u>KV</u>	<u>Total</u>
<u>Reforestation</u>			
Planting	1204	1525	2729
Seeding	33	3	36
Natural Regeneration	584	1851	2435
Sub-Total	1821	3379	5200
<u>Timber Stand Improvement</u>			
Release & Weeding	43101	21724	64825
Thinning	12937	2785	15722
Sub-Total	56038	24509	80547
<u>Total All Treatments</u>	57859	27888	85747

C. MANAGEMENT OBJECTIVES

1. Economic

- a. Produce on a sustained-yield basis the optimum volume of high-quality timber in the shortest time consistent with multiple-use management.
- b. Assist communities, industries, and area development councils to establish new wood industries to utilize the allowable cut.
- c. Make available the full allowable cut.

2. Silvicultural

- a. To secure the optimum growth of desired materials through application of the even-aged management system.
- b. To secure adequate regeneration in composition of species most desired for the site through harvest cuttings.

3. General Sustained-Yield Goals

- a. Attain a balance of 10-year-age classes on an area basis during the planned rotation period (100 years).
- b. Fully coordinate timber management practices with wildlife, water, and recreation resources in a manner consistent with the principles of multiple-use management.

TENTATIVE SUSTAINED-YIELD GOALS AND CURRENT STATUS

Site Index	Acres (M)	Volume Per Acre		Net Annual Growth		Conifer Volume (Cu.Ft.)
		Trees 5.0" DBH & Over	Trees 9", 11" DBH & Over	Trees 5.0" DBH & Over	Trees 9", 11" DBH & Over	
(Feet)		(Cu. Ft.)	(Bd. Ft.)	(Cu. Ft.)	(Bd. Ft.)	(%)
70+	91.9	4000	16,000	160	670	10
50-70	353.7	3000	9,000	100	350	40
30-50	7.3	2000	4,000	60	110	80

Forest Objective 452.9 3200 10,300 110 410 33

Forest Net Vol. in 1963 1400 ^{1/} 2,800 30 85 27 ^{1/}

Percent of Objective 44 28 28 21 36

^{1/} Derived from Table 13, page 10, of the Appendix.

To obtain the total Forest stocking, growth, and composition objectives stated above, a regulated series of age classes, with the above compositions, will have to be left on each site class. Expressed as a forest structure quotient, the ratio of number of trees per acre between successive age classes, the Forest will have a quotient of 1.4.

D. MANAGEMENT PRESCRIPTIONS

1. Silvicultural System

Even-age management will be applied to all Forest types.

2. Rotations

Plan rotation for the Forest is 100 years. This is less than the averaged silvicultural rotations due to needed adjustments in area condition acreage. Silvicultural rotations vary with stand type and site productivity. The rotations are based upon normal yield tables and mean annual growth rates.

Silvicultural Rotations by Site Index

Type	Age ^{1/} Site Index		Stand ^{2/} Average DBH	DBH Range
	-65	65+		
Yellow Pine	60	60-80	16" or merch. sawlog	14"-18"
Upland Hdwd.	-	100-120	18"	14"-22"
Cove Hdwd. & Hemlock	-	80-100	22"	20"-28"

1/ Basis - Sawlog production - There is a small area of the Forest with a site index - 50' which should be considered for pulpwood production.

2/ Basis - Pine - Produce optimum mean cubic foot annual increment.

Upland Hdwd. - Produce Forest Products Log Grade 1 butt log per tree, and optimum mean annual increment for the stand.

Cove Hdwd. - Produce 2 Forest Products Log Grade 1 logs per tree, and optimum mean annual increment for the stand.

3. Stand Treatment Guidelines

a. General

The broad objective of management on the Cumberland National Forest is to grow the optimum volume of high-quality sawtimber in the shortest practicable time. This requires full utilization of site potential by securing optimum stocking of the desired species and maintaining stand growth at the highest rate compatible with site capability.

The basic management unit in the even-aged system is the stand. All silvicultural treatments are directed to the manipulation of the stand; specific treatments are selected based on species silvics, stand condition and management objectives.

The objective in recognizing individual stands is to isolate each group of trees having similar characteristics and occupying substantially uniform areas of sufficient size as to be managed as discrete units. Such management normally requires the uniform application of one or more silvicultural treatments at timed intervals, in order to maintain desirable growth of the stand as a unit and meet management objectives within a stated period of time (rotation). Stand breakdowns should be no finer than that required to isolate areas where uniform treatment is practical. For planning purposes, the minimum practical size is 10 acres; and stands below this size should not be recognized as individual units.

The objective of the treatment may be either the improvement and/or maintenance of the existing stand or the establishment of a new stand. An existing stand is maintained at the desired basal area and growth level through the control of stand density and composition, i. e., condition of the growing stock. New stands are established through artificial or natural regeneration. The existing stand will be removed through commercial sales where possible; otherwise it will be removed by non-commercial means. The latter decision requires a judgment of the economic feasibility of the treatment.

Under even-aged management, three broad stand treatments may be prescribed; they are: intermediate, regeneration or no treatment.

b. Intermediate Treatment

Intermediate treatments of timber stands are those stand improvement measures applied during the period between regeneration and rotation age. All treatments will follow priorities shown in Part 5 of this section.

(1) Stands Age 1-20 Years

Artificial or naturally regenerated pine stands will need a minimum of one release between the second and fifth year and possibly another release during the fifth to tenth year, depending upon the competition and growth rates. By age 5, there should be a minimum of 400 crop trees per acre free to grow in this stand.

Naturally-regenerated hardwood stands are not expected to need subsequent releases after initial site preparation work. Weedings are recommended whenever undesirable sprout growth is seriously hindering the desired seedlings or seedling sprouts. By age 20, there should be 200 to 250 crop trees per acre free to grow.

(2) Stands Age 21 - 40

Hardwood stands will need a crop tree release and thinning. Residual stands should contain 150 - 200 crop trees per acre free to grow, or appropriate basal area stocking levels shown by site and age in the Appendix.

Growing stock levels to be maintained in coniferous stands are appended. First commercial improvement cuts of conifers are expected at this age.

(3) Stands Age 41 - 60

Stand thinnings will be primarily by commercial means. On the better sites, some small sawtimber yields can be expected. Where markets are lacking, non-commercial thinnings on the better sites should be made during the 10-year period. Residual basal area stocking levels apply to all sites.

(4) Stand Age 61 +

All thinnings are expected to be made through commercial sales. Stands in Area Conditions 4 and 5 not expected to reach Area Condition 3 by rotation should be regenerated.

c. Regeneration Treatments

Regeneration treatments will be applied to mature and over-mature stands. Such treatments will also be applied to immature stands that are in Area Conditions 4 and 5 and are not expected, through ingrowth, to reach Area Condition 3 prior to rotation age. (Refer. page 17).

The choice of species or species associations to be regenerated on a given site depends upon the silvics of the species and its adaptability to that site. As a basic guide to meeting management objectives, the following tables show the species recommended for three site class groups, and the usual regeneration cutting method to achieve this desired composition.

SPECIES - SITE - RECOMMENDATIONS
(Desirable Growing Stock)

<u>Preferred Species</u> ^{1/}	<u>Site Index</u> ^{2/} 75+	<u>Desired Management Type</u>
Hemlock Yellow Poplar Cucumber Basswood N. Red Oak White Oak Black Walnut White Pine Black Oak		Cove Hardwoods & Hemlock 75%+
	<u>Site Index 65-75</u>	
Red Oak Black Oak White Oak Chestnut Oak Yellow Pine White Pine Yellow Poplar	SI-75 ↑ ↓ SI-65	Upland Hardwood & Pine Types, with hardwood volume of 51 to 75% to Pine & Upland Hardwood Types, with 51-75% of volume in pine
	<u>Site Index <65</u>	
Black Oak White Oak Chestnut Oak Shortleaf Pine Virginia Pine Pitch Pine White Pine		Pine Types, with pine volume over 75% Upland Hardwood 10-25%

1/ Not in order of desirability or acceptability. Preferred species are those which usually occur naturally on the site, can be reproduced (and released) with little difficulty, grow rapidly, and produce high-valued products.

2/ Site Index = Oak at age 50

REGENERATION METHODS

<u>Stand Types</u>	<u>Methods</u> ^{1/}	<u>Remarks</u>
Pine	Stand	No desired seed source - Artificial regeneration - Direct seed or plant. Site preparation required.
	Seed tree (8-12 trees/ acre)	When seed source is available in a seed year. Scarification (site preparation)required. Virginia pine - with litter cover, site preparation required.
	Seed tree or Shelterwood	White pine - partial shade needed initially on S & SW aspects; site preparation required when litter covers ground.
Cove Hardwoods	Stand	Yellow poplar - seed trees not normally required - Seed available in duff. Site preparation may be needed.
	Seed tree or Shelterwood	Red oak and other species - advanced reproduction (seedling sprouts) must be available to use seed tree or stand cutting method.
Hemlock	Stand	Old growth hemlock - seed should be supplied by adjacent wind-firm groups.
	Shelterwood	Hemlock 60-80 years old can be regene. ated by 2 or 3 cut shelterwood
Upland Hardwoods	Stand	Oaks and hickory - advanced reproduction (seedling sprouts) must be availabe. If inadequate, supplement with pine species.
	Shelterwood	Two or 3 cut method where advanced reproduction is lacking or inadequate

1/ The only stems remaining on a regeneration area following post sale treatment should be the seed trees, desirable reproduction, and non-competitive stems of other species. All other stems should be removed.

Size of the managed stand will be dictated by natural stand limits^{1/} and area condition classes of the major stand area and adjoining stands. Thus, boundaries of a regeneration area may be modified as required to incorporate adjacent stands of insufficient size to form distinctly manageable stand units in themselves.

Coordination with other resources will influence the upper limit on the size of regeneration areas. For example, shape and distribution of the regeneration areas are important considerations in wildlife habitat management. See Part 6 of this section under Coordination.

Usually, a reproduction cutting consists of three removal operations; the first, removing the major volume of sawtimber and/or products, reserving seed sources; the second, removing unmerchantable trees and understories; and the third, removing the seed source.

Whenever possible, stand cut and seed tree cut reproduction areas should be a minimum of 10 acres. Maximum size should usually be dictated by natural stand limits.

d. No Treatment

No intermediate silvicultural treatments will be given immature stands if the basal area and stocking level are at or below the recommended densities for treated stands (Table 20 , Appendix). In such stands, treatments should be deferred to another cycle; do not be concerned with stand improvement when removal of trees will reduce stocking below the desired basal area but not release acceptable growing stock. (Exception: salvage)

4. Stand Condition Guidelines

Area Condition Class refers to a classification of stands based upon relative stocking of desired trees

1/ "Natural stand limits" are usually determined by topographic features relating to site and aspect, cultural features such as roads, or the characteristics of adjoining manageable areas.

and other conditions affecting current and prospective timber growth. There are five classes reflecting various levels of desirable stocking. Area condition is an important guide to prescribing silvicultural treatments.

In prescribing treatment, refer to the following table of area condition classes and general treatment recommendations:

<u>Area Condition Class</u>	<u>Treatment Recommendations</u>
1. 71% or more of area dominated by desirable <u>1</u> / trees free to grow.	Thin if overstocked. Otherwise, no treatment.
2. 41% to 70% of area dominated by desirable trees free to grow, with less than 30% of area dominated by other trees and shrubs.	Treatment variable with stand age, site, and species. Thin immature stands, regenerate mature and overmature stands.
3. 41% to 70% of area dominated by desirable trees with more than 31% of the area dominated by other trees.	Treatment variable with stand age, site, and species. Thin immature stands, regenerate mature and overmature stands.
4. 40% or less of area dominated by desirable trees; seed source and seedbed acceptable, with no inhibiting plant cover for seedlings of desirable species for the site.	Regenerate. Remove canopy. No site preparation necessary to secure desirable reproduction. Release and weeding may be necessary to maintain it. Thin overstocked stands which are being retained for wildlife habitat needs and/or area control objectives.
5. 40% or less of area dominated by desirable trees; seed trees and/or seedbed not acceptable for reproduction or inhibiting plant cover for seedlings of desirable species occupy the site.	Regenerate. Remove canopy. Additional treatment, such as scarification seeding or planting will be necessary to achieve desirable regeneration. Thin overstocked stands which are being retained for wildlife habitat needs and/or area control objectives.
<u>1</u> / Desirable tree - Growing stock trees having no serious defects in quality limiting present or prospective use; of relatively high vigor and containing no pathogens that may result in death or deterioration before rotation age. They include the type of trees forest managers aim to grow, that is, trees favored in cultural operations or featured in management in under-rotation age stands.	

5. Stand Treatment Priorities

Stand treatment priorities are determined by a comparative analysis between stands of:

- a. Growth potential or site capability
- b. Silvicultural considerations of stand stocking and condition
- c. Economics - cost and returns

Priority Guides

a. Growth

Stands will be treated according to the following order based on site capability^{1/}:

- (1) Hardwood type - Oak Site Index 75+
Pine type - " " " 65+
- (2) Hardwood type - Oak Site Index -75
Pine type - " " " -65

b. Economic and Silvicultural Considerations

Cost dictates that first priority be given to silvicultural treatments accomplished through commercial sales. Regeneration and intermediate cuttings will be accomplished according to the following priorities.

(1) Commercial treatments

(a) Regeneration cuttings

Stands killed or badly damaged
Overmature stands
Immature stands in Area Conditions
4 and 5^{2/}
Mature stands in Area Conditions
2 and 3

(b) Intermediate Cuttings

All stands in need of intermediate treatment.

^{1/} Based on L. A. Schnurr's Oak Site Index

^{2/} Except immature stands capable of becoming AC 3 by rotation age

(2) Non-Commercial Treatments

Stands in need of intermediate treatments will receive priority over stands to be regenerated.

(a) Intermediate Cuttings

Pole and small sawtimber stands
Sapling stands
Two-storied stands with desirable understory and undesirable overstory

(b) Regeneration Cuttings

Area Condition Class 4
Area Condition Class 5

6. Coordination

a. General

The coordination measures included here are for the purpose of defining the means by which the even-aged system of management is modified to coordinate its practices with wildlife, water, and recreation management objectives.

b. Wildlife

Timber management practices - the timing, scope and nature of such - have a more profound influence on the character of wildlife habitat than any other National Forest activity.

Even-aged silvicultural practices, properly coordinated with wildlife management objectives, offer great opportunities and flexibility in the planned manipulation of forest habitat.

Coordination requires implementation and modification of the timber management practices with an eye to meeting wildlife food and cover needs and in a manner that is consistent with the objectives of timber

management under the principles of multiple-use management.

Coordination Objectives

- (1) Achieve a balance of age classes consistent with habitat requirements. Guides in preparing compartment management prescriptions for each cutting cycle:
 - (a) Minimum 10% of compartment area should be regenerated.
 - (b) Minimum 10% of compartment area should be retained in 80-year + age class, or oldest available age class.
 - (c) Normally not more than 25%, but not to exceed 50%, of compartment will be regenerated in one cutting cycle.
- (2) Achieve the desired quality and interspersion of stands by age class, species, and area.

Guides are as follows:

(a) Regeneration Cuts

Minimum size (continuous and contiguous areas) - 10 acres^{1/}

Maximum size - a width averaging less than 10 chains - Because of natural stand limits, areas will normally be less than 50 acres.

Regeneration areas should be separated by and interspersed with residual stands of 10 acres minimum size. A minimum of 10% of the compartment area should consist of coniferous stands or be regenerated to coniferous species.

(b) Intermediate Cuts

Objective - Stands will be managed to carry a variety of food-producing species of desirable stems and sufficient den trees to meet wildlife needs. Through the proper selection of crop

^{1/} Except where other values are involved

trees, this objective can be accomplished without substantially affecting stand value.

Upland hardwood and pine hardwood types

Retain or encourage 25% of basal area in a variety of mast-producing species of kinds other than the single predominate species in the stand. At least 5% shall be of favored wildlife food species; especially hickory, black gum, or beech. The remainder may be oaks, yellow poplar, etc. Retain active den trees up to 3 per acre, or encourage potential den trees where active ones are not present.

Lowland hardwoods and pine types

Retain or encourage 10-25% of basal area in a variety of mast-producing species of kinds other than the single predominate species in the stand. At least 5% shall be of favored wildlife food species; especially hickory, black gum, or beech. The remainder may be oaks, yellow poplar, etc. Retain active den trees up to 3 per acre, or encourage potential den trees where active ones are not present.

Where release cuts are made in two-storied sapling and pole stands of 10 acres or more, overstory trees will be retained in scattered groups. Such overstory trees will aggregate 5 to 10 square feet of basal area, and preferably arranged in clumps of five or more vigorous stems. If possible, trees should be selected which are not suppressing desirable understory stems. Clumps or trees should be distributed wherever possible at not more than 10 chain intervals. Such overstory trees will be retained until food and cover values are furnished by the released saplings or poles.

c. Recreation

(1) Travel and Water Influence

This zone contains scenic areas developed and undeveloped recreation sites with their needed buffers, and the primary foreground along lakes, streams, roads, and trails used principally for recreational purposes. Areas are specified in the Districts' Multiple Use Plans. Timber management practices will be employed in this zone to protect, enhance, or develop the recreation values. Stand treatments will be modified to remove safety hazards, high-risk trees, and such volume of timber that will improve, enhance, or retain a pleasing view and preserve any unusual scenic features or trees which might be present. Adequate supervision of logging operations, relative to slash disposal, stump heights, and damage to residual trees, will be required.

(2) General Forest Zone

This zone contains the balance of the general forest area with a permanent road system open to the public. The timber management prescriptions outlined in this Plan are applicable to this area without modification; and the following recreational benefits can accrue:

- (a) A mosaic of stand conditions most favorable for wildlife that will improve hunting and the opportunity to observe wildlife and plant communities.
- (b) A landscape that will be manipulated to provide a managed forest environment in which people may find purposeful and pleasurable dispersed-type recreation with a minimum of restrictions.

d. Soil and Water

The soil resource, a major factor in determining site quality and productivity, serves as a basis for planning silvicultural practices. Timber management programs will provide the following:

- (1) Establishment of a timber stand structure and species composition that will serve as a soil builder or maintainer while improving infiltration and percolation rates and the water storage potential of the soil mantle.
- (2) Size, shape, distribution and interspersion of regeneration cuts will be modified in accordance with topographic and soil conditions. Pending completion of soil surveys such modification will be guided by the wildlife coordination instructions in 6b Section D.
- (3) Sale planning and administration conducted so as to insure the protection of soil and water resources with major emphasis on maintenance and improvement of water quality.

E. MANAGEMENT CONTROLS

1. Inventory

Inventories of total volume, growth, stand type, condition, and age will be made at periodic intervals, prior to Management Plan revisions and in accordance with national and regional standards. Modifications of inventory instructions will be made to meet local needs. Growth will be based upon remeasurement of the permanent plots. New aerial photography and a soil site index map (10' intervals) will be available prior to the next inventory.

2. Compartment Examination

Each compartment in the working circle will be examined during the Plan period. A minimum of 45,000 acres, or 10%, of all compartments will be scheduled each year for examination. This information will be used to establish a 3-year cutting budget and the 3-year TSI program consistent with the treatment priorities and coordination instructions established in this Plan.

3. Examination of Regeneration Areas

Regeneration cuttings and artificial regeneration areas will be examined at least twice during the first five years following clear-cutting or treatment. Intervals are 1, 3, and 5 years, depending upon successful stand establishment. Successful stand stocking after 5 years will consist of the following:

<u>Species</u>	<u>Min. No. of Trees/Acre</u>
Pine	400 trees free to grow
Hardwood	1500 trees free to grow ^{1/}

Examination procedures are established in the Forest Service Handbook.

1/ 500 of these should be potential crop trees of preferred species.

4. Allowable Cut Guides

(Annual allowable cut based on area control with volume check)

	Districts (Blocks)							
	Morehead	Stanton	Berea	London	Somerset	Stearns	Williamsburg	Forest
Reproduction Cut								
Acres	790	500	670	500	620	980	440	4,500
% of Total	17	11	15	11	14	22	10	100
Estimated Yield								
MMBF	1.8	2.0	2.2	2.3	3.3	4.9	2.4	18.9
Intermediate Cut								
Acres	1880	1600	1350	1120	2340	3500	1710	13,500
% of Total	14	12	10	8	17	26	13	100
Estimated Yield								
MMBF	2.6	2.3	1.9	1.6	3.3	5.0	2.4	19.1
Total Acres	2670	2100	2020	1620	2960	4480	2150	18,000
% of Total	15	12	11	9	16	25	12	100
Estimated Yield								
MMBF	4.4	4.3	4.1	3.9	6.6	9.9	4.8	38.0

F. MANAGEMENT RECORDS

Records of the planned and accomplished treatments will be maintained in compartment folders and program inventory binders. These will include:

1. Compartment

- a. Stand map and data summary record
- b. Reforestation and Stand Improvement Plan and Record, R7-2400-38
- c. Map of treatments
 - (1) Sale area - Prescription and accomplishment record showing regeneration, intermediate, and non-treated areas, year treated and sale area betterment accomplishments
 - (2) TSI & Multiple-use coordination - Show wild-life leave groups, key habitat areas, heli-spots, special treatment areas, and TSI accomplishments.

2. Program Inventory

- a. Regeneration Area Inventory Record
- b. Compartment Examination Inventory Record
- c. Three-year cutting budget
- d. Atlas map - cutting budget and year treated
- e. Sale Area Betterment Inventory

Consult the Forest Service Handbook for instructions for maintaining such records.

G. COMMERCIAL SALES POLICY

1. Size of Sales

The Forest's small-sales program provides approximately 300 sales per year, representing 30% of the sold volume. Small sales will be provided at the present level to meet the needs of dependent residents in economically-distressed areas. Attempts will be made to enlarge the size of individual small sales units and decrease the frequency of sales to individual operators, depending upon stability of the market. These sales should be made in selected areas, near centers of demand, covering compartments progressively until all treatments necessary from a silvicultural standpoint have been completed, i. e., products-hardwood charcoal.

Integrated sales, i. e., sawtimber and products, shall be made when market conditions favor this type of sale.

Large sales average 1.0 MMBF, usually ranging from 200 MBF to 2,500 MMBF and seldom exceeding 3.0 MMBF.

General policy will be to increase the average size of the larger sales in order to develop an access road system. This is necessary in order that the maximum amount of stumpage is made available for the development of road needs for the Plan period (Section H, page 30).

2. Utilization Standards

	Tree		Unit	
	DBH	Top DIB	Length	DIB
Hardwood Sawlogs	11"	10"	8'	10"
Softwood Sawlogs	9"	8"	8'	8"
Pulpwood	5"	4"	5'	4"
Posts	6"	5"	7'	5"

4. Logging Methods

Logging methods will be flexible and adaptable to the sale area to be cut. Objectives are given below.

- a. Encourage tree-length logging within the regeneration cutting areas in order to minimize site preparation costs.
- b. Encourage uphill winch or cable skidding from "skidding sets" within regeneration cuts, especially below the cliff lines to reduce logging costs and minimize watershed damage and site preparation costs. Temporary road construction will be avoided in areas that can be more economically logged by cabling.
- c. Encourage uphill tractor skidding with a planned system of logging spur roads: de-emphasize mule skidding.
- d. Provide, through administration and planning of logging operations, adequate protection of the residual stems in the treatment of intermediate-aged stands.
- e. Encourage sound utilization practices and maximum recovery of merchantable material through bucking for high-grade yield, cutting low stumps, minimizing jump cuts, etc.

H. Forest Development Program

1. Timber Stand Improvement

a. Needs

Prior to 1960, most timber stand improvement was accomplished by commercial timber sales and post-sale treatments through Knutson-Vandenberg (K-V) funds. These funds were inadequate to meet timber stand improvement objectives. Markets restricted sale operations primarily to sawtimber size stands and limited improvement efforts to less than 2% of land area annually. After 1960, appropriated funds (P&M) became available for stand improvement investments on non-sale areas. Since 1963, or the start of the 10-year development plan for the National Forests, appropriated funds became available in sufficient amounts to meet the program objective. Total accomplishments with all appropriations in F.Y. 1963 and F.Y. 1964 was 42,180 acres.

Stands in which improvement work would be profitable were determined on a sample basis as part of the 1962 inventory. A total area of 147.5 M acres should be given cultural treatments in this Plan period. Part of this area, or an estimated 23,000 acres, can be treated by commercial sales through the Forest's limited products market. The balance should be given cultural treatments with appropriated investment funds.

b. Policy

Wherever possible, stand improvement practices should be accomplished by commercial sales to pulpwood and charcoal markets.

Pre-commercial investments will be made first in compartments where there exists the potential for the most favorable cost benefit ratio. Studies indicate the greatest rates of return are from the best sites in pole-size stands. However, positive rates of return on investment costs can be realized from all sites and stand conditions on the Forest.

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Priority investment of K-V money, when funds are limited, will be directed toward the necessary follow-up treatments on regeneration areas and to the thinning and release of established reproduction. When K-V financing is inadequate, P&M funds should be used to complete this job. Stand treatment priorities (Section D) guide alternative investments.

Forest-appropriated funds should be allocated to districts proportionate to the magnitude of the acreage of intermediate-age stands in need of pre-commercial treatment, and as modified by the presence or absence of products markets.

c. Program

A total area of 147.5 M acres should be given cultural treatments during this Plan period. The following program is planned to be accomplished uniformly during the 10-year period.

<u>SUMMARY OF TSI PROGRAM</u>			
<u>Type of Treatment</u>	<u>Acres</u> ^{1/}	<u>Estimated Cost</u>	
		<u>Total</u>	<u>Per Acre</u>
Potential Pulpwood and Charcoal Sales (Supplemental funds-P&M)	23,000	69,000	\$3.00
Pre-commercial cultural improvement practices	58,500	1,287,000	\$22.00
Post Sale Areas (K-V)	-	-	-
Total	147,500	2,148,000	\$14.56

^{1/} Acreage derived from Table 6, Appendix.

2. Reforestation

a. Needs

The total acreage to be regenerated is 214,000 acres. Total non-sale acreage needing regeneration because of unproductive stand condition is 77,500 acres. In commercial sale areas, there are 135,600 acres needing regeneration. During this Plan period, a total of 57,000 acres is planned for regeneration in order to maintain a reasonable distribution of age classes. The balance of 157,000 acres will be regenerated in the next 3 cutting cycles.

The Forest's remaining open plantable land of approximately 1200 acres will not be reforested during the Plan period. Most of these areas are small and scattered and will be developed for wildlife habitat needs and other resource uses, such as recreation sites.

b. Policy

Regeneration cuts on hardwood and coniferous sites will be planned to obtain natural regeneration wherever practical. Artificial means will be utilized in the areas where prompt natural regeneration is not possible, i. e., between good pine seed crops^{1/}, or in areas to be regenerated to species other than those occupying the site.

Due to problems associated with hardwood seeding and plantings, pilot-size trials will be initiated during the Plan period. Pilot trials will be made with high-value species such as black walnut and yellow poplar.

Planting rather than seeding will usually be done on those pine soil types which have a high natural succession rate to hardwoods and on areas previously regenerated and insufficiently stocked. Planting stock standards and spacing as prescribed in the Regional Handbook will be followed. Spacing will usually be between 8'x8' and 10'x10'.

^{1/} Adequacy of seed year - determined by cone count or seed traps. Minimum requirements will be shown in Forest Service Handbook.

Seed and seedlings produced should be from Forest seed production areas or approved seed sources. Direct seeding will be restricted to areas given site preparation treatments.

Direct seeding - spot or broadcast of conifers will be done on areas to supplement the natural seed source, or on regeneration areas most economically suited to this type of reforestation.

c. Program

The reforestation program will consist of regenerating 57 M acres. Approximately 16 M acres will be regenerated artificially.

The following program is planned to be accomplished uniformly over the Plan period.

SUMMARY OF REFORESTATION PROGRAM			
	Estimated Costs		
	Acres	Total	Per Acre
Commercial timber sale regeneration areas	45,000	\$1,446,000	\$32.20
Open lands	0		
Stands to be regenerated with appropriated funds	12,000	888,000	\$74.00
Total - - - - -	57,000	\$2,334,000	\$41.00

3. Tree Improvement

A program to establish coniferous seed production stands was initiated in F.Y. 1965. Three-hundred acres of seed production stands will be established during the Plan period. The production expected from this acreage exceeds Forest needs. The acreage shown reflects Regional requirements for shortleaf and virginia pine seed.

During the Plan period, an estimated 8,000 acres will be direct seeded and 8,000 acres planted. Total Forest seed requirements will be approximately 4800 pounds.

Cone collection projects will be continued from timber sale areas during abundant seed years until the seed production areas are established and become productive. Extraction, treatment, and storage facilities available at the State nursery or commercial seed producers are planned for use in the Forest's program.

Forest-collected seed will be used whenever possible for direct seeding. Seed will also be supplied to the Kentucky State Nursery for production of seedlings needed for Forest planting programs.

4. Insect and Disease Control

a. General Condition

Known losses from an analysis of species of insects and diseases have been minor. Collectively, it is estimated that this damage is considerable because of the large number of species present.

(1) Insects

Damaging insects are present on the Forest but mostly in an endemic stage. Mortality losses are relatively minor. The Virginia Pine Sawfly has severely defoliated small scattered groups of shortleaf pine on the north end of the Forest during the past two years. Southern pine bark beetles, pine sawflies, tip moths, and weevils are the principal pests to the conifers; borers, cankerworms, leaf and tent caterpillars concentrating on the hardwoods.

Timber-degrading losses are more apparent. Insect problems are hardwood borers and carpenter ants, particularly on the poorer sites.

(2) Disease

Diseases present on the Forest are insidious in nature. Most damage results from defect and cull, and not from actual killing. Diseases recognized are *Fomes annosus*, *Fomes pini*, Littleleaf, Oak wilt, and Oak dieback. The effects of diseases in terms of value losses have not been evaluated.

Littleleaf disease occurs in immature and mature stands of shortleaf pine. Mortality losses are minor, occurring principally on the London, Williamsburg, and Stearns Districts.

Fomes annosus has been detected in both natural and planted shortleaf pine stands, mainly as a saprophyte. Areas being thinned will be under surveillance. Preventative treatments will be applied in thinning treatments if there is evidence of a change from saprophytic to parasitic status.

b. Programs

(1) General Control

Studies may be initiated during the Plan period to determine the extent of degrading damages from insects and diseases and what control measures are justified. Inventory data indicated that mortality losses are minor.

Natural control, obtained through stand treatment measures and the manipulation of present and future stand composition will be the principal protection from pest activities.

Chemical control will be used to suppress epidemic insect attacks. If effective, biotic control will be used in place of chemical control measures.

Prior to initiating any large-scale biotic or chemical control measures, a complete evaluation will be made by the Forest Pest Control Zone Supervisor and the Forest staff.

(2) Insect Control

Fifty-eight observation plots have been established throughout the Forest, keyed to specific insect pests. To determine population trends and where buildups in populations indicate control needs, these plots will continue to be examined and new ones established upon the advice of the Zone Pest Control Supervisor.

(3) Disease Control

Observation and surveillance procedures will be established to recognize and evaluate losses due to disease.

The cooperative oak wilt surveillance program with the State of Kentucky will continue. Stands afflicted with *Fomes annosus* will be harvested and preventative measures to control spread will be taken as needed.

B. Fire

a. Annual Loss

Fire control organization and prompt suppression action, through the use of helicopters to transport the initial attack crews has reduced the annual acreage burn. Except for 1963 the burned acreage was within the objectives established by the 1959 fire planning project.

<u>Year</u>	<u>Total Acres Burned</u>
1960	278
1961	197
1962	179
1963	1743
1964	149

Tolerable annual acreage burn (1959 fire planning) = 486.

Although fire losses to individual stands may be damaging and may require immediate action, i. e., salvage and reforestation, fires cause relatively little damage to the timber resource on the working circle. With the continuation of the current prevention and control efforts, forest fires need not be a consideration in timber management planning.

b. Use of fire as a silvicultural tool

Fire is presently being used on a trial basis on regeneration areas to dispose of heavy concentrations of slash and to assist in site preparation work. More intensive use will be investigated.

6. Transportation

a. Needs and Status

The problem of providing access has become more critical in recent years. The transportation system is presently inadequate to provide access to the 180,000 acres of timber stands in need of commercial treatment during the Plan period. Without adequate access, neither the timber management objectives nor multiple-use management objectives, as stated in this Plan and elsewhere, can be accomplished.

To meet the road construction requirements necessary to effectively manage the land, a more intensive reconstruction and maintenance program will be required of county and State agencies, and the Forest Service. To be of mutual benefit, close cooperation between State, county, and the Forest Service will be required. Many public roads are below all-weather traffic standards. The Forest's construction program will have to be more closely keyed to a complete multiple-use concept, in order to bring the road construction program into line with the user demands.

A review of the Forest road development construction programs over the past several years shows that prior to F.Y. 1963, road construction averaged approximately 5 miles per year. Between one and two miles of this was to provide access to recreation areas.

The Forest's transportation system is shown below:

<u>Status</u>	<u>Interim Development Road (IDR)</u>	<u>Land Access Road (LAR)</u>	<u>Land Use Road (LUR)</u>	<u>Total</u>
	- - -	- Miles -	- - -	-
Existing	903	213	185	1303
Planned	86	201	1259	1546 ^{1/}
Total	989	414	1444	2849

It is estimated that 540 miles of road will have to be constructed or reconstructed during the 10-year Plan period in order to treat, through commercial timber sales, the 180,000 acres of allowable cut area.

b. Policy

The policy of the Forest will be to secure completion of the 540 miles of Forest development roads needed during the Plan period to accomplish the Timber Management Plan objective of treating 180,000 acres.

Appropriated funds are not expected to be available for this construction. Therefore, it will be the policy to utilize timber-operator construction whenever possible to secure completed Forest development roads.

Appropriated funds will be utilized to supplement operator construction when stumpage is inadequate to finance road construction costs and maintain a minimum return to the counties in the form of the 25% fund. As a guide in planning, the Forest has established by districts a minimum residual stumpage^{2/} per MBF of sawtimber volume sold. It is the objective of the residual stumpage rate to assure a minimum contribution to NFF, thus protecting the 25% fund, and to serve as a planning base for road and K-V assessments.

^{1/} Includes 144 miles of existing roads which are classed as primitive. These roads receive little, if any, maintenance, are sub-standard to user needs, and were considered as non-existing.

^{2/} Residual stumpage rates are found in the Forest Service Handbook.

In securing operator-built roads out of stumpage, due care will be taken to comply with sound multiple-use management and silvicultural guidelines as stated in this Plan. If funds from stumpage, plus supplementation, are inadequate to meet road construction costs, the sale will be postponed.

State and county agencies will be encouraged, through cooperative agreements, to actively participate in this transportation development program, particularly on those roads which are basic to the local transportation systems.

c. Program

It is planned to accomplish 54 miles of road construction annually during the Plan period. This must be accomplished by timber-purchaser construction, supplemented by appropriated funds and/or cooperative agreements with local governments for construction and reconstruction to the basic standard. The annual cost of these roads is estimated at \$325,000. Of this total, it is expected that \$82,000 will be provided from appropriated funds and that \$8,000 will be supplied by local governments.

APPENDIX

Table 1.

AREA BY LAND CLASSES

<u>Land Class</u>	<u>Acres</u>
Commercial forest land	452,896 <u>1/</u>
Unproductive forest land	28
Productive - reserved forest land	190 <u>2/</u>
Total forest land	453,114
Non-forest land	7,463 <u>3/</u>
All land	460,577

1/ Sampling error in percent - 0.00%2/ Rock Creek Natural Area3/ National Forest acreage summary - June, 1964

Table 2.

AREA OF COMMERCIAL FOREST LAND BY
FOREST TYPE AND STAND SIZE

Forest Type	All Stand: Sizes	Sawtimber: Stands	Poletimber: Stands	Seedling : and : Sapling : Stands	Non- Stocked Stands
	Acres				
Shortleaf-Loblolly Pine	35,646	26,606	7,954	472	614
Oak-Hard.Pine	110,954	93,260	14,176	1,368	2,150
White Oak	17,683	9,881	7,137	387	278
Oak-Hickory	212,174	166,956	43,177	762	1,279
Mixed Hardwoods	76,297	67,120	8,052	497	628
Bottomland Hardwoods	142	142	-	-	-
All Types	452,896	363,965	80,496	3,486	4,949

Table 3.

AREA OF COMMERCIAL FOREST LAND BY
RANGER DISTRICT AND STAND AGE

Ranger District	0-20 Yrs.	21-40 Yrs.	41-60 Yrs.	61-80 Yrs.	81-100 Yrs.	101-120 Yrs.	121+ Yrs.	Uneven Age	District Total
	- -	- -	- -	- -	- -	- -	- -	- -	- -
Berea	3905	24767	18427	11514	5754	1191	-	2440	67,998
London	2815	12129	18245	7803	3591	1751	963	2785	50,082
Morehead	1752	23897	26180	15608	8258	323	852	2635	79,505
Somerset	955	12273	18177	19651	6203	2218	937	1799	62,213
Stanton	880	13834	14294	9400	6507	1776	1029	3199	50,919
Stearns	1672	19384	30234	29121	8805	3077	2370	3359	98,022
Williams- burg	681	8564	12424	13100	5323	1434	660	2021	44,157
Forest Total	12610	114848	137981	106197	44441	11770	6811	18238	452,896

Table 4.

AREA OF COMMERCIAL FOREST LAND BY
RANGER DISTRICT AND SITE CLASS

Ranger District	Site 1 70'+	Site 2 50-70'	Site 3 30-50'	All Sites
	- -	- -	- -	- -
Berea	9,646	57,884	468	67,998
London	11,512	37,127	1443	50,082
Morehead	15,225	62,328	1952	79,505
Somerset	14,670	47,064	479	62,213
Stanton	13,337	36,686	896	50,919
Stearns	20,541	76,269	1212	98,022
Williamsburg	6,998	36,356	803	44,157
Forest Total	91,929	353,714	7253	452,896

Table 5.

AREA OF COMMERCIAL FOREST LAND BY
RANGER DISTRICT AND AREA CONDITION CLASS

Ranger District	Area Condition Class					
	1	2	3	4	5	Total
	-	-	-	-	-	-
	-Acres-					
Berea	11,879	1,559	31,835	47	22,678	67,998
London	8,198	3,725	17,088	702	20,369	50,082
Morehead	7,394	2,085	27,992	-	42,034	79,505
Somerset	5,979	1,386	23,651	-	31,197	62,213
Stanton	9,230	778	17,241	-	23,670	50,919
Stearns	9,387	3,506	33,739	-	51,390	98,022
Williamsburg	4,732	988	16,550	-	21,887	44,157
Forest	56,799	14,027	168,096	749	213,225	452,896

Table 6.

AREA OF COMMERCIAL FOREST LAND BY
AREA CONDITION CLASS AND BY TREATMENT CLASSES

Treatment Class	Area Condition Class					
	1	2	3	4	5	Total
	- - -	- - -	- - -	- - -	- - -	- - -
	Acres					
No treatment	39038	7772	65468	636	321	113235
Sawtimber sale in stands over rotation age	694	-	14054	-	123213	137961 ^{3/}
Sawtimber sale in stands under rotation age	8716	1944	18408	-	-	29068 ^{3/}
Sawtimber and/or pulpwood sale of sawtimber over- story in two- storied stand	631 ^{1/}	1085 ^{1/}	12087 ^{1/}	113 ^{3/}	11319 ^{3/}	25235
Pulpwood sale in stands under rotation age	3417	852	6169	-	347	10785 ^{1/}
TSI-Intermediate Cut	4303 ^{2/}	2374 ^{2/}	50803 ^{2/}	-	79	57559
TSI-Regeneration Cut	-	-	1107 ^{2/}	-	77474	78581
Special protection	-	-	-	-	-	-
Special work groups	-	-	-	-	472	472
Forest Total	56,799	14,027	168,096	749	213,225	452,896

^{1/} Acreage of potential pulpwood & charcoal sales during the Plan period. Refer to lc, Section H.

^{2/} Acreage in need of pre-commercial improvement treatments during Plan Period. Refer to lc, Section H.

^{3/} Total acreage to be considered for intermediate sawtimber cuts during Plan period, less acreage of area condition 4 & 5 which will be regenerated (45,000 acres). Approximately 45% (66,000 acres) of this acreage will receive post sale treatment (K-V) during the Plan period. Refer to lc, Section H.

Table 7.

AREA OF COMMERCIAL FOREST LAND BY
STAND VOLUME CLASSES FOR SAWTIMBER AND
OTHER STAND SIZE CLASSES

Stand Volumes Per Acre ^{1/}	Area by stand size classes		
	All Stands	Sawtimber Stands	Other Stands
	- - -	Acres - - -	- - -
Less than 1500 board feet	88,931	-	88,931
1500-5000 board feet	300,073	300,073	-
More than 5000 board feet	63,892	63,892	-
All Classes	452,896	363,965	88,931

^{1/} Net volume, International 1/4-inch rule

Table 8.

AREA OF COMMERCIAL FOREST LAND BY
STOCKING CLASSES BASED ON ALTERNATIVE STAND COMPONENTS

Stocking Percentage	Stocking Classified in Terms of		
	All Trees	Growing Stock Trees	Desirable Trees
	- - - - - Acres - - - - -		
90-100	375,300	186,979	8,982
80-90	54,133	77,375	13,845
70-80	15,930	63,873	33,972
60-70	6,786	47,558	43,751
50-60	747	27,955	75,834
40-50	-	21,321	62,327
30-40	-	12,419	64,514
20-30	-	6,505	60,757
10-20	-	3,962	48,047
Less than 10	-	4,949	40,867
All Areas	452,896	452,896	452,896

Table 9.

AREA OF COMMERCIAL FOREST LAND BY
STOCKING CLASSES OF GROWING STOCK TREES AND BY
STAND SIZE CLASSES

Stocking Class	All Stands	Sawtimber Stands	Poletimber Stands	Seedling & Sapling Stands	Nonstocked Stands
	- - -	- - -	- - -	Acres - - -	- - -
70% or more	328,227	267,500	58,294	2433	-
40 to 70%	96,834	76,904	18,877	1053	-
10 to 40%	22,886	19,561	3,325	-	-
Less than 10%	4,949	-	-	-	4949
All Classes	452,896	363,965	80,496	3486	4949

Table 10.

NUMBER OF TREES (GROWING STOCK AND CULL) PER ACRE
ON COMMERCIAL FOREST LAND BY DIAMETER CLASSES AND BY
SOFTWOODS AND HARDWOODS

DBH Class (Inches)	Growing Stock Trees		Cull Trees		Total
	Softwood	Hardwood	Softwood	Hardwood	
2"	38.29	109.28			147.57
4"	22.37	64.27			86.64
Sub-Total	60.66	173.55			234.21
6"	9.50	30.58	2.11	13.31	55.50
8"	6.83	16.63	1.09	5.64	30.19
10"	4.93	10.51	.63	4.05	20.12
12"	3.72	7.67	.36	2.90	14.65
14"	2.11	4.55	.17	1.63	8.46
16"	1.05	2.71	.09	1.03	4.88
18"	.45	1.27	.05	.59	2.36
20"	.18	.62	.02	.32	1.14
22"	.10	.27	.01	.23	.61
24"	.06	.19	-	.16	.41
26"	.03	.09	-	.10	.22
28"	.02	.04	-	.03	.10
30"	.01	.02	-	.03	.06
32"	-	.01	-	.01	.02
34"	-	-	-	-	.01
36"	-	-	-	.01	.01
38"	-	-	-	-	-
Over 40"	-	-	-	-	-
Sub-Total	28.99	75.17	4.53	30.04	138.73
Total	89.65	248.72	4.53	30.04	372.94

Table 11.

BASAL AREA (GROWING STOCK AND CULL TREES) PER ACRE
ON COMMERCIAL FOREST LAND BY DIAMETER GROUPS AND
BY SOFTWOODS AND HARDWOODS

DBH Group (Inches)	Growing Stock Trees		Cull Trees		Total
	Softwood	Hardwood	Softwood	Hardwood	
	- - -	- - -	- - -	- - -	- - -
	Square Ft.				
2-4"	2.78	7.97	-	-	10.75
6-10"	7.00	12.72	1.15	6.86	32.73
12-16"	6.67	14.72	.59	5.47	27.45
18-22"	1.45	4.31	.16	2.35	8.27
24" +	.44	1.26	-	1.28	2.98
Total	18.34	45.98	1.90	15.96	82.18

Table 12.

NET BOARD FEET VOLUME OF SAWTIMBER GROWING STOCK
ON COMMERCIAL FOREST LAND BY RANGER DISTRICTS

Ranger District	Softwood	Hardwood	Total
	- - -	-Thousand Board Ft.	- - -
Berea	33,766	136,645	170,411
London	66,391	80,197	146,588
Morehead	33,356	170,943	204,299
Somerset	74,919	101,618	176,537
Stanton	52,434	115,341	167,775
Stearns	128,850	150,983	279,833
Williamsburg	60,942	84,010	144,952
Forest Total	450,658	839,737	1,290,395 ^{1/}

^{1/} Sampling error in percent:
 Total volume + 1.35
 Per billion bd.ft. + 1.19 A-9

Table 13.

NET CUBIC FOOT VOLUME OF TIMBER ON
COMMERCIAL FOREST LAND BY CLASS OF TIMBER
BY SOFTWOODS AND HARDWOODS

<u>Class of Timber</u>	<u>All Species</u>	<u>Softwoods</u>	<u>Hardwoods</u>
	- - - Thousand cu.ft. - - -		
<u>Sawtimber trees:</u>			
Sawlog portion	295,454	118,967	176,487
Upper stem portion	<u>57,753</u>	<u>12,283</u>	<u>45,470</u>
Total	353,207	131,250	221,957
<u>Poletimber Trees</u>	170,025	25,401	144,624
<u>All Growing-Stock Trees</u>	523,232 ^{1/}	156,651	366,581
<u>Sound cull trees:</u>			
Sawtimber-size trees	56,313	10,121	46,192
Poletimber-size trees	<u>35,681</u>	<u>3,872</u>	<u>31,809</u>
Total	91,994	13,993	78,001
<u>Rotten cull trees:</u>			
Sawtimber-size trees	11,606	1,024	10,582
Poletimber-size trees	<u>4,477</u>	<u>237</u>	<u>4,240</u>
Total	16,083	1,261	14,822
Total All Timber	631,309	171,905	459,404

1/ Sampling error in percent:
Total volume $\pm$ 0.89
Per billion cu. ft. $\pm$ 1.25

Table 14.

NET VOLUME OF GROWING STOCK AND SAWTIMBER ON
COMMERCIAL FOREST LAND BY STAND SIZE CLASSES AND
BY SOFTWOODS AND HARDWOODS

Stand Size Class	All Species	Softwoods	Hardwoods	Per Acre
	GROWING STOCK			
	Million Cubic Feet			Cubic Ft.
Sawtimber	458.6	140.1	318.5	1260
Poletimber	62.7	15.6	47.1	779
Sapling & seedling	.7	.3	.4	201
Non-Stocked	1.2	.6	.6	242
All Stands	523.2	156.6	366.6	1155
	SAWTIMBER			
	Million Board Feet ^{1/}			Board Ft.
Sawtimber	1215.5	420.2	795.3	3340
Poletimber	70.8	28.0	42.8	879
Sapling & Seedling	1.5	.9	.6	430
Non-Stocked	2.6	1.6	1.0	525
All Stands	1290.4	450.7	839.7	2849

^{1/} International ½-inch rule

Table 15.

NET VOLUME OF GROWING STOCK ON COMMERCIAL FOREST LAND
BY SPECIES AND DIAMETER CLASSES

SPECIES	Diameter Class (Inches at breast height)										
	All	9.0-	11.0-	13.0-	15.0-	17.0-	19.0-	21.0-	23.0-	29.0-	39.0 &
	Classes	10.9	12.9	14.9	16.9	18.9	20.9	22.9	28.9	38.9	Larger
	-Thousand Board Feet-										
<u>Softwoods</u>											
White Pine	14,644	1,464	1,908	1,643	2,718	2,318	1,290	1,341	1,558	404	
Hemlock	71,161	3,660	5,472	6,090	8,115	8,940	9,071	9,556	16,812	3439	
Shortleaf Pine	267,299	51,127	71,644	69,027	44,987	21,794	6,542	1,481	693	--	
Other Yellow Pines	97,269	26,745	31,514	21,335	11,359	4,319	1,072	290	631	--	
Red Cedar	285	75	51	159	--	--	--	--	--	--	
All Softwoods	450,658	83,077	110,589	98,254	67,179	37,371	17,979	12,668	19,698	3843	
<u>Hardwoods</u>											
Sugar Maple	5,986	--	1,442	1,159	974	769	656	198	623	165	
Red Maple	12,584	--	3,659	2,540	2,443	1,147	1,078	893	298	430	96
Select Red Oak	41,221	--	8,721	7,186	8,334	4,914	3,864	2,941	4,879	382	--
Other Red Oak	229,006	--	55,719	62,642	52,230	26,325	14,069	7,975	9,144	655	247
Select White Oak	154,052	--	39,702	39,798	27,457	20,286	9,081	6,288	8,962	2478	--

Table 15. (Con'd)

SPECIES	Diameter Class (Inches at Breast Height)										
	All Classes	9.0- 10.9	11.0- 12.9	13.0- 14.9	15.0- 16.9	17.0- 18.9	19.0- 20.9	21.0- 22.9	23.0- 28.9	29.0- 38.9	39.0- 48.9
	-Thousand Board Feet - - - - -										
Hardwoods											
Other White Oak	75,366		16,391	16,389	15,667	8,734	5,290	3,090	7,792	2,013	
Yellow Birch	305		48	-	100	157	-	-	-	-	
American Beech	22,729		1,411	2,028	2,736	4,378	4,125	2,673	5,024	354	
White Ash	5,520		1,175	1,335	1,620	162	211	78	819	120	
Basswood	9,944		1,533	1,928	1,439	1,326	1,242	282	2,194	-	
Yellow Poplar & Cucumber	118,613		28,029	29,533	23,450	13,983	10,724	6,323	6,127	444	
Hickory	121,205		32,672	32,838	24,191	16,992	5,871	3,048	5,327	266	
Cottonwood & Aspen	361		117	-	165	79	-	-	-	-	
Sweet Gum	9,661		1,722	1,997	1,924	2,153	929	323	342	271	
Black Tupelo	21,726		4,807	5,239	4,379	3,802	2,017	549	683	250	
Black Walnut	2,687		1,197	685	433	139	151	-	82	-	
Other Hardwoods	8,771		2,018	1,624	2,092	667	1,079	277	661	353	
All Hardwoods	839,737		200,363	206,921	169,634	106,013	60,387	34,938	52,957	8,181	
All Species	1,290,395	83,077	310,952	305,175	236,813	143,384	78,366	47,606	72,655	12,024	

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Table 16.

NET VOLUME OF GROWING STOCK ON COMMERCIAL FOREST LAND
BY SPECIES AND DIAMETER CLASSES

SPECIES	Diameter Class (Inches at Breast Height)												
	All Classes	5.0- 6.9	7.0- 8.9	9.0- 10.9	11.0- 12.9	13.0- 14.9	15.0- 16.9	17.0- 18.9	19.0- 20.9	21.0- 22.9	23.0- 28.9	29.0- 38.9	39.0- Larger
- Thousand Cubic Feet -													
<u>Softwoods</u>													
White Pine	4,743	365	158	449	562	464	764	664	383	387	432	115	-
Hemlock	22,637	1,054	1,138	1,130	1,604	1,733	2,288	2,572	2,698	2,752	4,698	970	-
Shortleaf Pine	90,363	3,551	8,936	15,712	21,014	19,609	12,671	6,287	1,956	427	200	-	-
Other Yellow Pine	38,815	3,100	7,090	8,273	9,185	6,107	3,223	1,251	321	84	181	-	-
Red Cedar	93	9	23	15	46	-	-	-	-	-	-	-	-
All Softwoods	156,651	8,079	17,322	25,587	32,380	27,959	18,946	10,774	5,358	3,650	5,511	1,085	-
<u>Hardwoods</u>													
Sugar Maple	3,285	621	634	460	444	288	254	192	171	46	141	34	-
Red Maple	6,502	1,326	926	901	1,128	633	638	289	280	208	69	86	18
Select Red Oak	13,530	662	932	1,202	2,698	1,797	2,176	1,227	991	682	1,089	74	-
Other Red Oak	94,026	8,382	10,848	13,942	17,194	15,654	13,641	6,610	3,641	1,854	2,075	138	47
Select White Oak	79,720	11,855	13,438	13,588	12,262	9,949	7,172	5,092	2,347	1,459	2,043	515	-

Table 16. (Con'd)

SPECIES	Diameter Class (Inches at Breast Height)												
	All Classes	5.0- 6.9	7.0- 8.9	9.0- 10.9	11.0- 12.9	13.0- 14.9	15.0- 16.9	17.0- 18.9	19.0- 20.9	21.0- 22.9	23.0- 24.9	25.0- 26.9	27.0- 28.9
- Thousand Cubic Feet -													
Hardwoods													
Other White Oak	42,565	4,545	3,991	14,298	5,059	4,101	4,095	2,197	1,372	719	1,764	424	-
Yellow Birch	123	-	-	42	15	-	26	40	-	-	-	-	-
American Beech	6,390	103	273	342	432	505	715	1,103	1,069	624	1,151	73	-
White Ash	2,036	205	181	210	360	334	423	41	55	18	183	26	-
Basswood	3,045	48	227	237	474	481	376	330	319	65	488	-	-
Yellow Poplar	44,888	3,440	4,805	5,885	8,455	7,293	5,951	3,445	2,706	1,438	1,378	92	-
Hickory	53,523	5,431	7,059	8,628	10,097	8,211	6,325	4,268	1,528	711	1,210	55	-
Cottonwood- Aspen	127	-	28	-	36	-	43	20	-	-	-	-	-
Sweet Gum	3,618	176	477	438	531	499	503	543	239	76	78	58	-
Black Tupelo	6,591	210	82	553	1,480	1,306	1,142	956	528	127	155	52	-
Black Walnut	1,257	94	203	214	369	172	113	34	40	-	18	-	-
Other Hdwds.	5,355	586	763	1,133	825	490	709	186	357	86	148	72	-
All Hdwds.	366,581	37,684	44,867	62,073	61,859	51,713	44,302	26,573	15,643	8,113	11,990	1,699	65
All Species	523,232	45,763	62,189	87,660	94,239	79,672	63,248	37,347	21,001	11,763	17,501	2,784	65

Table 17.

NET BOARD FOOT VOLUME OF SAWTIMBER
ON COMMERCIAL FOREST LAND BY
SPECIES AND QUALITY CLASSES

Species	All Classes	Grade 1	Grade 2	Grade 3	Tie and Timber Logs
	- - - -	-Thousand Board Feet - - - -			
<u>Softwood</u>					
White Pine	14644	-	5141	9503	-
Yellow Pines	364568	14583	70435	279550	-
Other Softwoods	71446	*	*	*	*
All Softwoods	450658 ^{1/}	14583	75576	289053	-
<u>Hardwood</u>					
Select White Oak	154052	10169	33429	79613	30841
Select Red Oak	41221	7380	10965	19907	2969
Other White Oak	75366	-	12103	35784	27479
Other Red Oak	229006	-	15367	104266	109373
Hickory	121205	9296	15623	59463	36823
Yellow Birch	305	9	9	257	30
Hard Maple	5986	-	300	4669	1017
Sweet Gum	9661	-	1095	2456	6110
Ash, Walnut, Black Cherry	8255	1258	1399	4302	1296
Yellow Poplar	116510	24571	34220	41224	16495
Other Hardwoods	78170	1430	18004	48560	10176
All Hardwoods	839737	54113	142514	400501	242609
All Species	1,290,395 ^{1/}	68696	218090	689554	242609

^{1/} Non-graded other softwood volume included.

* Not applicable. Other softwoods not graded.

Note: Grade is a function of log diameter and other factors. More volume in Grade 3 is prospectively higher grade but the trees have not yet attained the larger diameter needed to qualify as Grade 1 or 2.

Table 18.

NET VOLUME BY SPECIES - 1963 INVENTORY

Species	Thousand ^{1/} Cubic Feet	%	Thousand ^{2/} Board Feet	%
<u>Softwood</u>				
White pine	4,743	.9	14,644	1.1
Hemlock	22,637	4.3	71,161	5.5
Shortleaf pine	90,363	17.3	267,299	20.7
Pitch pine	13,093	2.5	37,204	2.9
Virginia pine	25,722	4.9	60,065	4.7
Red cedar	93	-	285	-
All softwoods	156,651	29.9	450,658	34.9
<u>Hardwoods</u>				
Red oak	14,208	2.7	42,277	3.3
Black oak	42,944	8.2	115,113	8.9
Scarlet oak	50,404	9.6	112,837	8.8
White oak	79,720	15.2	154,052	11.9
Chestnut oak	30,681	5.9	72,045	5.6
Post oak	11,884	2.3	3,321	.3
Yellow poplar,				
Cucumber and	49,198	9.4	129,350	10.0
Basswood				
Black walnut &	1,357	.3	2,972	.2
butternut				
Hickory	53,523	10.2	121,205	9.4
Other Hardwoods	32,662	6.3	86,565	6.7
All Hardwoods	366,581	70.1	839,737	65.1
Total All Species	523,232	100.0	1,290,395	100.0

1/ All growing stock trees (5.0"+)

2/ All sawtimber trees (9.0, 11.0"+)

Table 19.

NET PERIODIC GROWTH 1956 - 1962

	Conifer	Hardwood	Total
	(BF per acre)		
Accretion on Sawtimber Growing Stock (10,12"4)	15.2	21.2	36.4
Ingrowth in sawtimber size	18.7	29.7	48.4
Total Net PAI	33.9	50.9	84.8
(MBF on 452,896 acres)			
Accretion on Sawtimber Growing Stock	6,884	9,601	16,485
Ingrowth	8,469	13,451	21,920
Total Net PAI	15,353	23,052	38,405
(CF per acre)			
Accretion on Total Growing Stock (5"4)	9.8	13.8	23.6
Ingrowth into Pole Size	1.5	5.5	7.0
Total Net PAI	11.3	19.3	30.6
(MCF on 452,896 acres)			
Accretion on Total Growing Stock	4,439	6,250	10,689
Ingrowth	679	2,491	3,170
Total Net PAI	5,118	8,741	13,859

Table 20.

GENERAL STOCKING GUIDES FOR THINNINGUpland Oak -- Trees 5.0" DBH + 1/

<u>Stand Age</u> <u>(Yrs.)</u>	<u>Residual Basal Area by Site Index of Oaks</u>		
	<u>Best (70' +)</u>	<u>Average (50'-70')</u>	<u>Poorest (-50')</u>
30	55	50	45
50	67	60	55
70	80	75	65
90	95	85	75

1/ From USDA Bulletin #560, 1937: "Yield, Stand and Volume Tables for Even-Aged Upland Oak Forests", by L. A. Schnurr - Residual B.A. is about 67% of normal.

Yellow Poplar (Cove Hardwoods) All Trees 5.0" DBH + 1/

<u>Stand Age</u> <u>(Yrs.)</u>	<u>Residual Basal Area by Site Index of Poplar</u>		
	<u>Best (110' +)</u>	<u>Average (90'-110')</u>	<u>Low (70'-90')</u>
25	66	57	--
35	91	80	64
45	113	100	82
55	130	115	97

1/ 64% of basal area of normal stands; from USDA Technical Bulletin #356, 1933: "Yellow Poplar Characteristics, Growth, and Management, by E. F. McCarthy.

Shortleaf Pine 1/

<u>Stand Age</u> <u>(Yrs.)</u>	<u>Residual Basal Area by Site Index (S. Pine)</u>		
	<u>High (70' +)</u>	<u>Average (50'-70')</u>	<u>Low (-50')</u>
20	67	62	56
40	88	80	72
60	94	85	74
80	100	90	76
100	104	92	78

1/ 67% of normal basal area of dominant stand. USDA Miscellaneous Publication #50, Page 145 (Table 125).

Table 20. (Con'd)

<u>White Pine - 5.0" DBH +</u>			<u>1/</u>
<u>Stand Age</u> <u>(Yrs.)</u>	<u>Residual Basal Area by Site Index of Oaks</u>		
	<u>SI (40-Oak)</u>	<u>SI (60-Oak)</u>	
30	100	110	
40	120	130	
50	130	145	
60	135	150	
70	140	155	
80	145	160	

1/ 64% of normal. From Research Bulletin #98, "Second Growth White Pine in Wisconsin".

APPENDIX II

Growth and Mortality Analysis

In the 1956 inventory, 36 plots established in 1949 by the Central States Forest Experiment Station were remeasured, and 325 new permanent plots were established. In the 1962 reinventory, 154 of the 361 total growth plots on the Forest were selected for remeasurement. Included were 22 of the plots established in 1949. Analysis of the data collected from the plots has provided details on growth and mortality on the average forest condition existing today. Pertinent data are shown in the graphs and tables following.

Before studying the data, the reader should be aware that all of the data is subject to sampling error. Data were collected from plots established randomly in stratified volume classes within the commercial forest land. Sampling errors calculated on net cubic foot volumes in both inventories were $\pm 2.2\%$ in 1956 and $\pm 0.9\%$ in 1962. Errors on net board foot volumes were about double those for cubic foot. Sampling errors applicable to growth data for both periods have not been calculated. The relationship of sampling errors should be about the same for the growth plots as for total net volumes. Thus, growth data from the inventory of 1962 should have about six times the reliability as data from the inventory of 1956.

The same volume table and average heights by diameter classes were used in all three inventories. Volume changes shown are thus the result of increases in growth and numbers of trees. In plotting growth changes, data from the two inventory periods have not been "balanced" to adjust for the difference in sample sizes. That is, volume per acre calculated by the 1956 reinventory of 36 plots has not been adjusted to agree with the volume per acre for 1956 as shown in the 1962 reinventory of 154 plots. There appears to be a difference in average volume per acre in 1956. All of this apparent difference is the result of the differences in sampling size and sampling errors. Balancing of the data was not considered because 36 plots do not provide a large enough sample for completely acceptable breakdowns of various growth components shown in the graphs. A minimum number of plots needed for growth analysis as shown is thought to be about 80 plots.

Growth Analysis Results

1. Both board foot and cubic foot volume growth are lower than expected. Considering gross stocking in 1949 and 1956, an annual growth rate of over 5 to 6% should be expected.

Actual percent growth in the 1956 to 1962 period was 3.1% on cubic foot volume, 3.2% on board foot volume.

2. The average diameter growth on the Forest is slow. In both periods, average growth was about 0.9" in 10 years. This rate is about half of the expected average under full regulation of growing stock levels on a 7 to 10 year cutting and tending cycle.
3. Gross cubic foot stocking of all live trees increased from 1218 in 1949 to 1676 in 1962, or about 41% of the desired stocking levels of a fully regulated forest. The percent of conifer stocking remained relatively constant during this period. It was 28% in 1956, 26% in 1962. To best utilize soil-site potential, conifer stocking should be about 33% of the desired total stocking of $\pm$ 4000 cubic feet. Present stocking of 432 cubic feet in conifers is about 32% of desired levels.
4. Net board foot volume stocking and growth data reflect increasingly stricter sawtimber merchantability specifications for high value hardwoods. Merchantability classes recorded by the Central States Forest Survey teams in 1949 were changed to agree with National Forest sale and inventory specifications in 1956. Thus, growing stock trees made up 84% of the live tree volume in 1949 and 1956. In 1962, merchantability specifications were changed to include log grade, and growing stock volume decreased to 70% of live tree volume. Although it would be possible to arbitrarily assign log grades to the tree tallies of 1949 and 1956, it would not be a precise method of comparing net volumes from the three inventories. Without first reconciling the affects of changes in merchantability standards caused by market changes, net volume change figures alone become rather meaningless in continuous inventories.
5. Allowing for the light (36 plot) sample of 1949, the stand structure quotient of all live trees changed very little from 1949 to 1956, although the number of trees and cubic foot volume increased. Compared with the desirable structure and stocking curve, the current forest condition is far from satisfactory, as net growing stock volumes are only 70% of the live tree total, and the live tree total is only about 41% of desired volume. Until cull and slow-growing, older stands are regenerated and grow to cubic foot volume size (5" DBH), subsequent management plans should hold forest volume and structure quotients near the levels of 1949 to 1962. Thus, management objectives should be to maintain stocking levels at about 1600 cubic feet per acre (gross) until growing stock comprises more

than 95% of gross stocking. At this point, stocking levels of 3000 to 4000 cubic feet or more can be considered as plan objectives, and area-volume controls established to build up growing stock volumes to the desired levels.

6. The high structure quotients indicate that a preponderance of small tree or "young" age class stands occupy forest sites. Diameter growth rates infer that the small size of trees may be the result of unsatisfactory growth rates rather than age. Thus, "management" stand age is much less than biological stand age, because stands under management are expected to grow to certain diameters by specified ages, and current stands have not. Many stands have been noted in field projects that are at or above silvicultural rotation ages, but that contain average diameters well below those expected under management throughout a rotation period. Causes of poor diameter growth rates are many, the inability to time thinnings in such stands during the past 80 to 100 years, species poorly matched to soils for quality and growth purposes, cyclic moisture deficiencies during growing seasons probably are primary reasons; other reasons are fire, storm and other damaging factors. However, it is apparent that regeneration of existing slow-growing and low quality stands at less than diameter, size or rotation age objectives, must be considered in current management plans.

Forest Diameter Growth Rates, 1949-62

Average Annual Diameter Growth

DBH	1949-1956 :	1956-1962 :			Possible Rate in a Completely Managed Forest
	All Trees	All Trees	Conifers	Hdwd.	
6	0.083	0.099	0.118	0.091	0.100
8	0.100	0.112	.121	0.109	0.110
10	0.097	0.102	.071	0.112	0.120
12	0.162	0.091	.084	0.091	0.130
14	0.125	0.085	.050	0.095	0.140
16	0.247	0.091	.078	0.095	0.150
18	0.180	0.091	.129	0.085	0.160
20	0.174	0.088	.084	0.091	0.170
22	0.171	0.048	-	0.071	0.180
24		0.024	-	0.034	0.190
26		0.058	-	0.068	0.200
Forest Average	0.100	0.091	.094	0.090	0.150

Forest average growth rates are based on adequate sample size. Diameter growth rates by DBH classes below double lines are based on inadequate number of trees in sample; data above the double lines are assumed to be valid estimates.

GROSS BOARD FEET GROWTH ANNUALLY PER ACRE

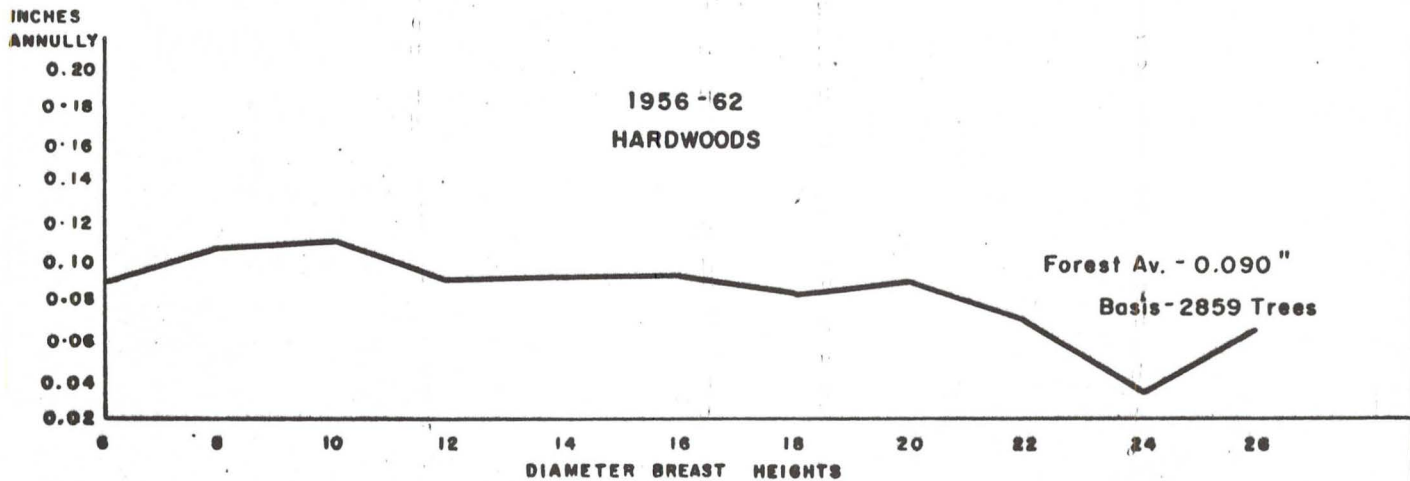
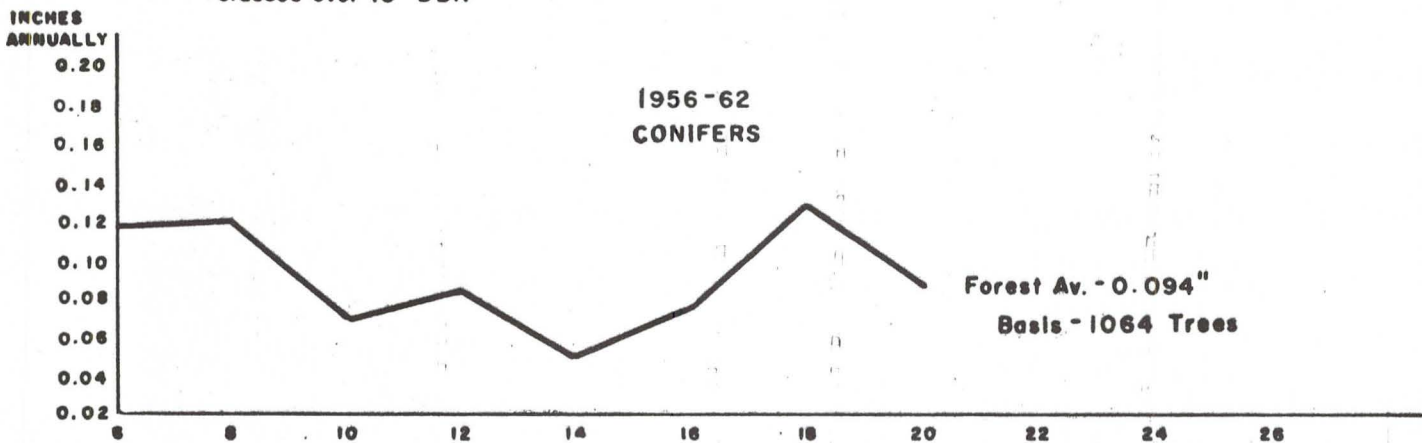
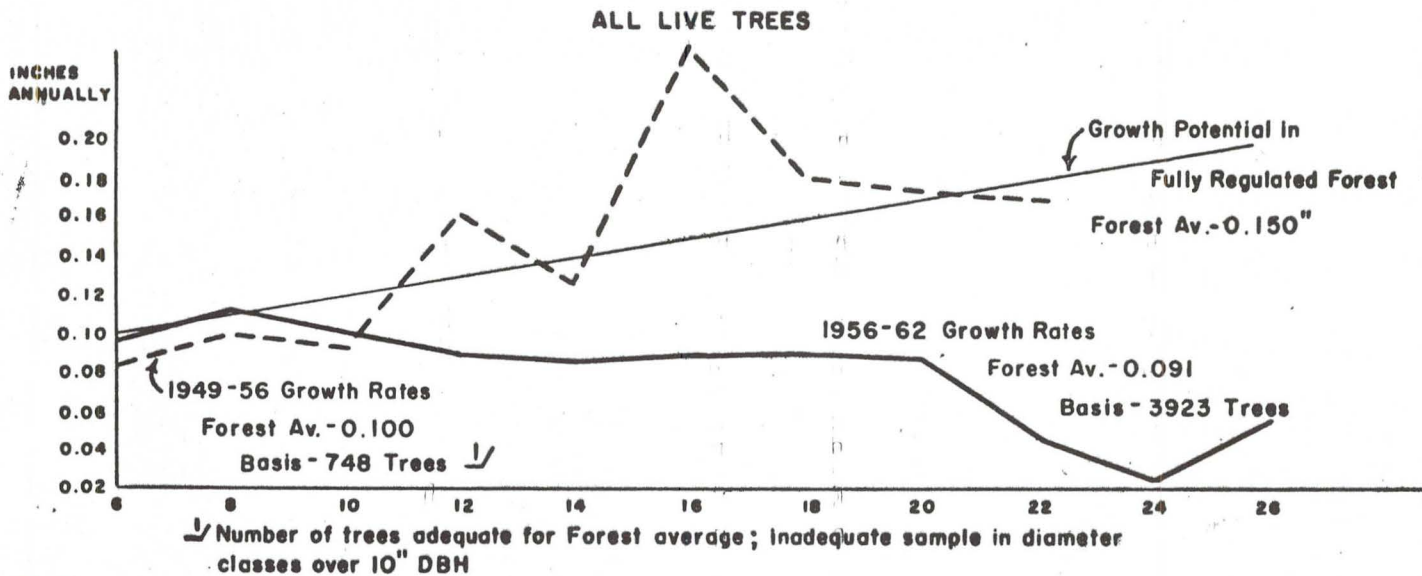
1949-1956 PERIOD (36 Plots)

<u>Accretion</u>	<u>All Trees</u>	<u>Conifer</u>	<u>Hardwood</u>	<u>Percent of Total</u>	<u>All Trees Growth Percent</u>
Trees 23"+	0.0	NA	NA	0	0
" 17"-23"	31.2	NA	NA	30	2.5
" 9,11"-17"	<u>72.1</u>	<u>NA</u>	<u>NA</u>	<u>70</u>	<u>3.9</u>
Total Accretion	103.3			64	3.3
9, 11" Ingrowth	<u>57.6</u>	<u>NA</u>	<u>NA</u>	<u>36</u>	<u>1.8</u>
Total	160.9			100	5.1

1956-1962 PERIOD (154 Plots)

Trees 23"+	1.2	--	1.2	2	0.2
" 17-23	14.3	<u>2.3</u>	12.0	21	1.0
" 9,11-17	<u>52.8</u>	<u>16.3</u>	<u>36.5</u>	<u>77</u>	<u>1.9</u>
Total Accretion	68.3	18.6	49.7	51	1.6
9, 11" Ingrowth	<u>67.0</u>	<u>19.6</u>	<u>47.4</u>	<u>49</u>	<u>1.6</u>
Total	135.3	38.2	97.1	100	3.2

**CUMBERLAND NATIONAL FOREST
AVERAGE ANNUAL DIAMETER GROWTH OF ALL LIVE TREES
ON REMEASURED PLOTS**



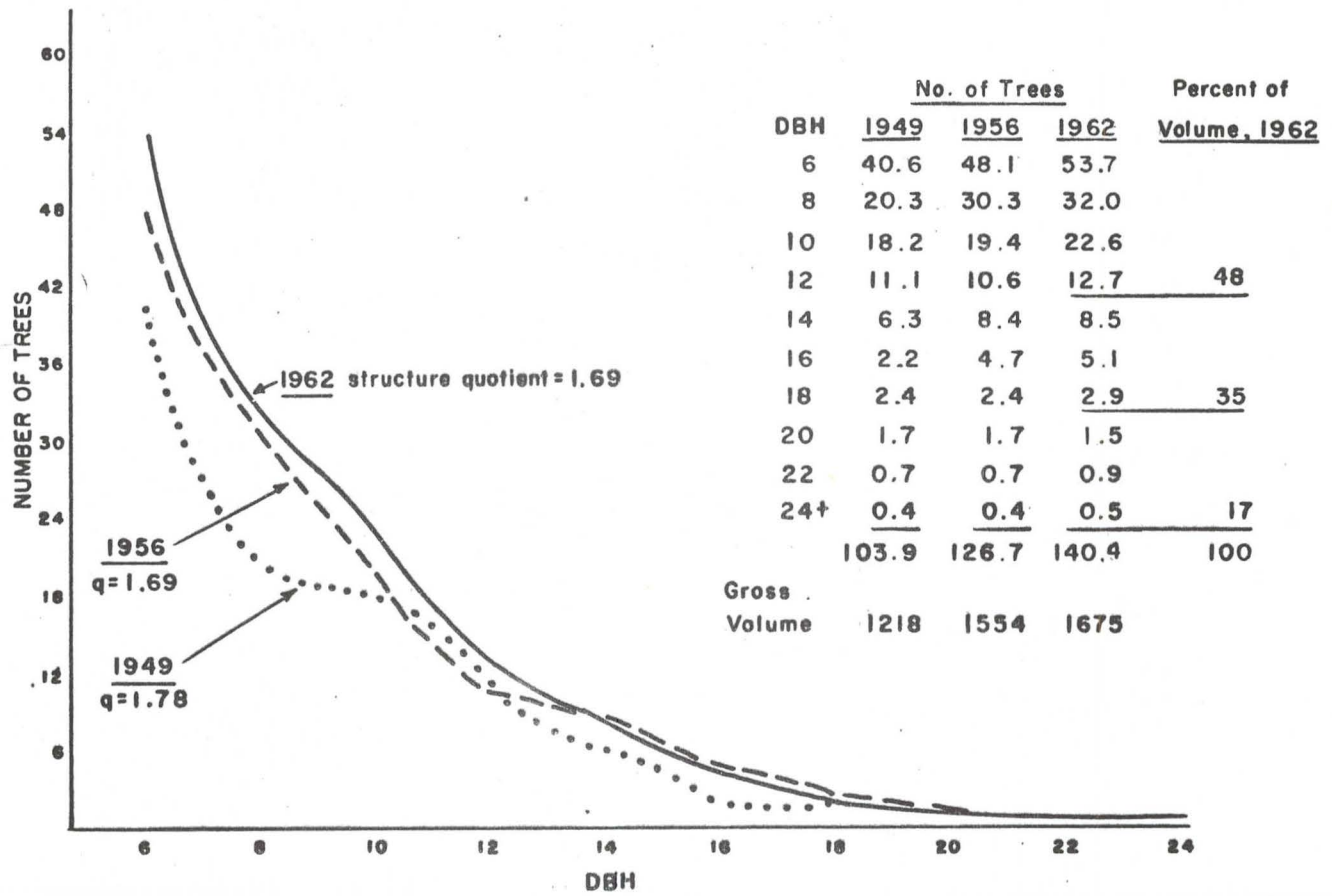
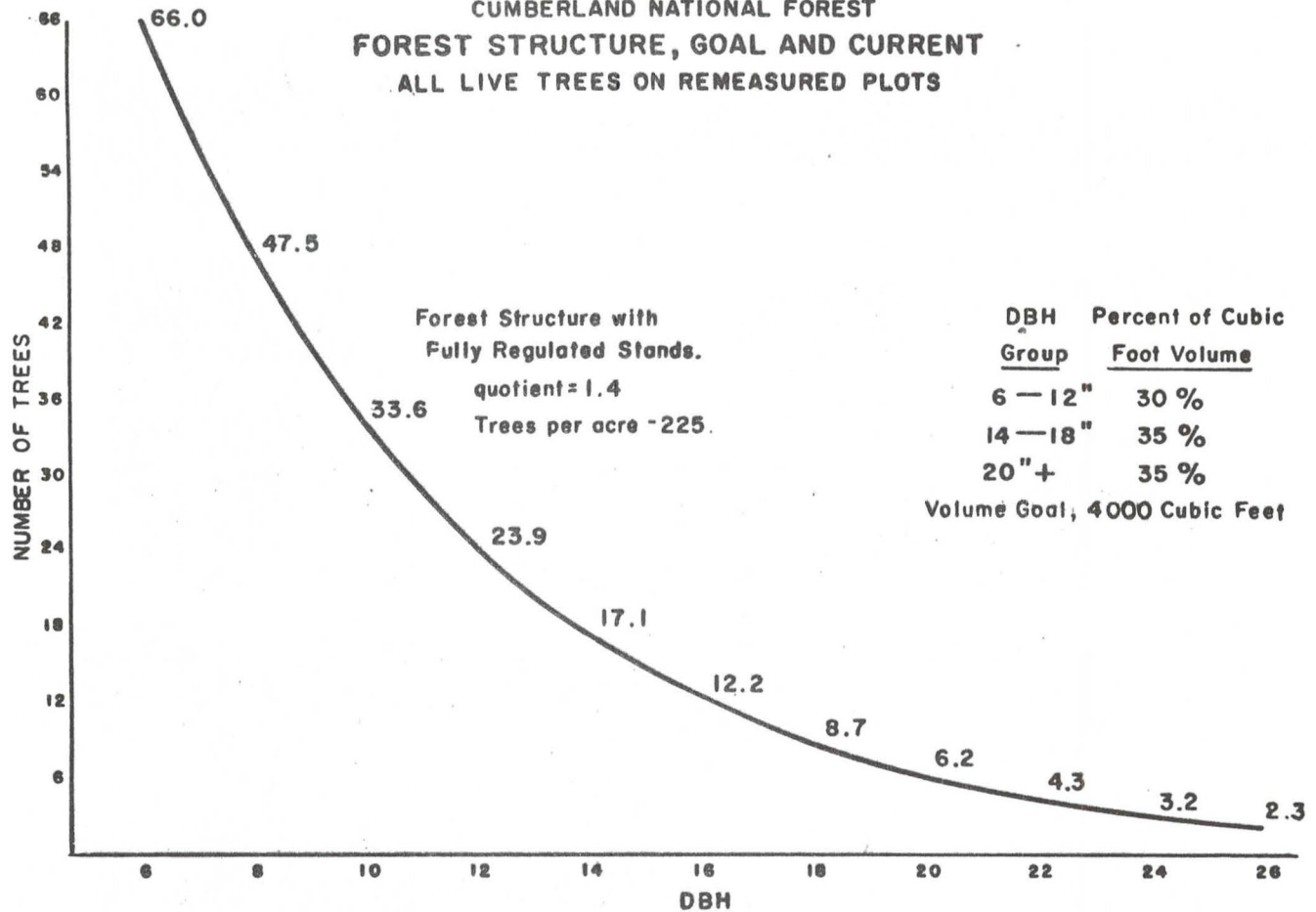
Years for all trees to grow 2.0" in DBH
of live trees tallied in 1962: (At 1956-62 rates)

All trees - 22 years

Conifers - 21 "

Hardwoods - 22 "

**CUMBERLAND NATIONAL FOREST
FOREST STRUCTURE, GOAL AND CURRENT
ALL LIVE TREES ON REMEASURED PLOTS**



CUMBERLAND NATIONAL FOREST

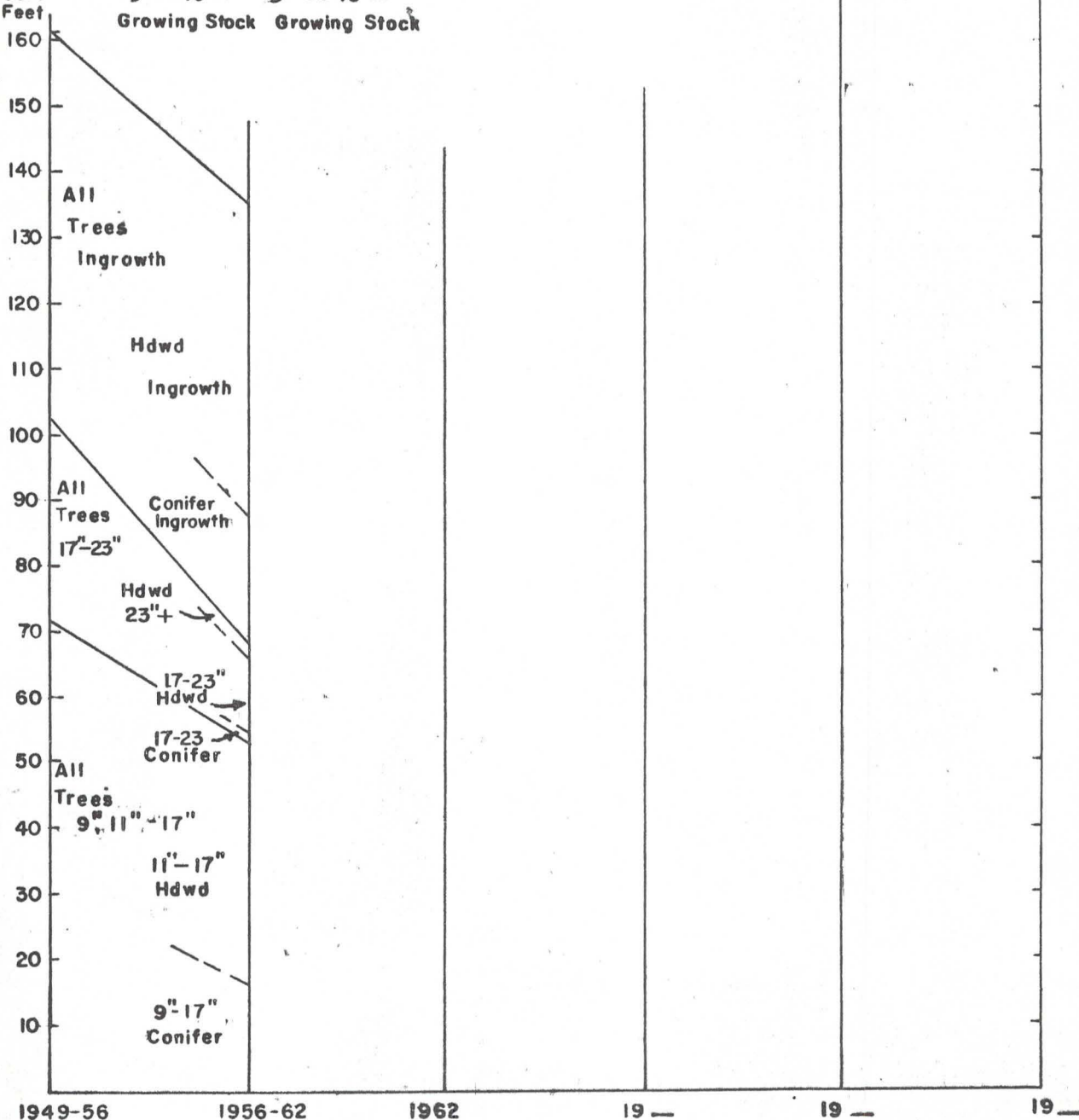
Gross Periodic Annual Board Foot Increment on Remeasured Plots

All Live Trees

Net Growth - Summary

	<u>1949-56</u>	<u>1956-62</u>		
	All Trees	Con.	Hdwd.	Total
All Trees	160.9	38.2	97.1	135.3
Mortality	<u>56.4</u> 1)	<u>2.6</u>	<u>20.5</u>	<u>23.1</u> 2)
Net - All Trees	104.5	35.6	76.6	112.2
Cull Trees	<u>16.7</u>	<u>1.7</u>	<u>25.7</u>	<u>27.4</u>
Net, Gr, Sk.	87.8	32.9	50.9	84.8

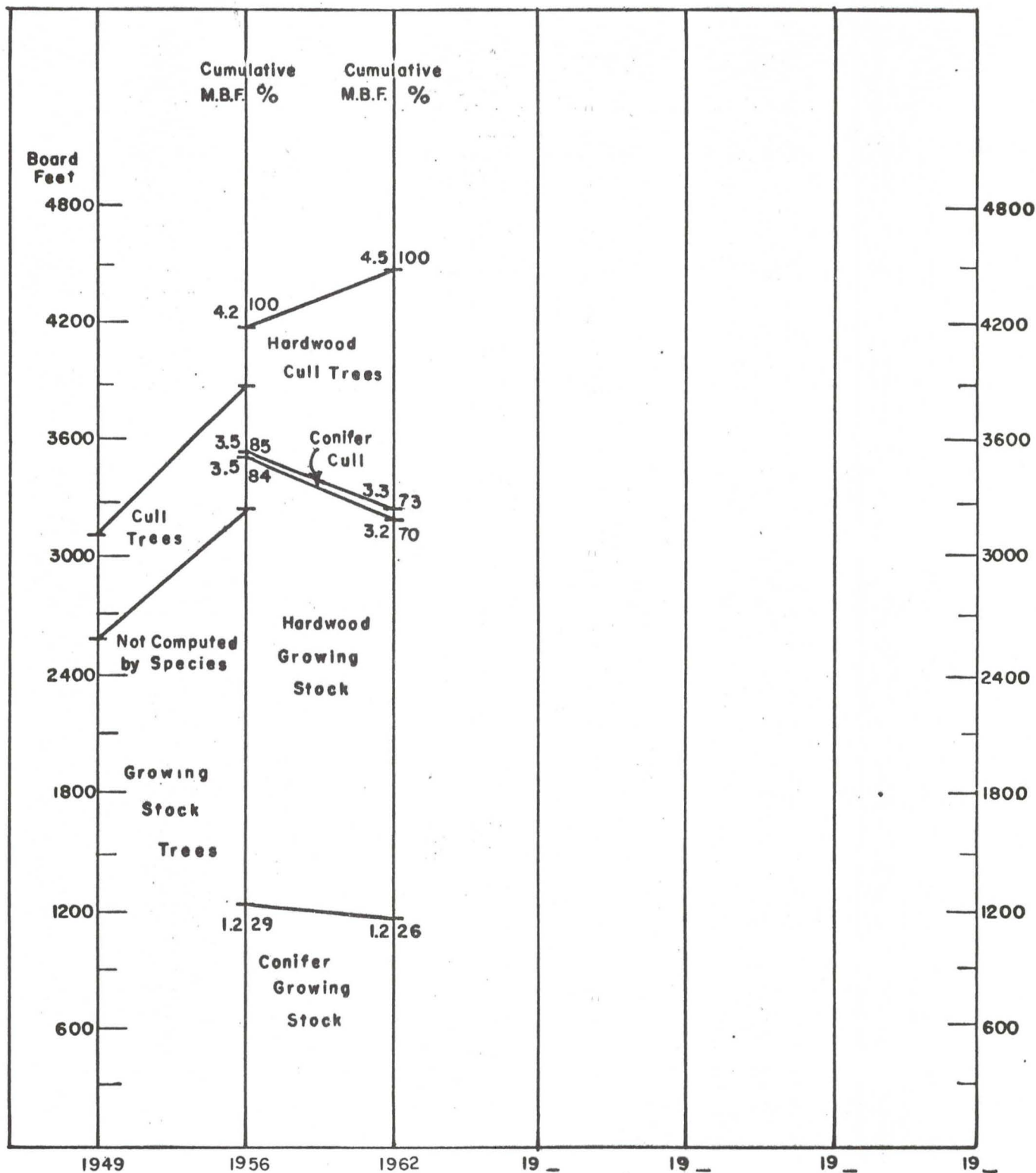
Board Feet 1 60% in 2 55% in
 Growing Stock Growing Stock



CUMBERLAND NATIONAL FOREST

Gross Board Foot Volume of Growing Stock and Cull Trees Per Acre

All Live Trees on Remeasured Plots

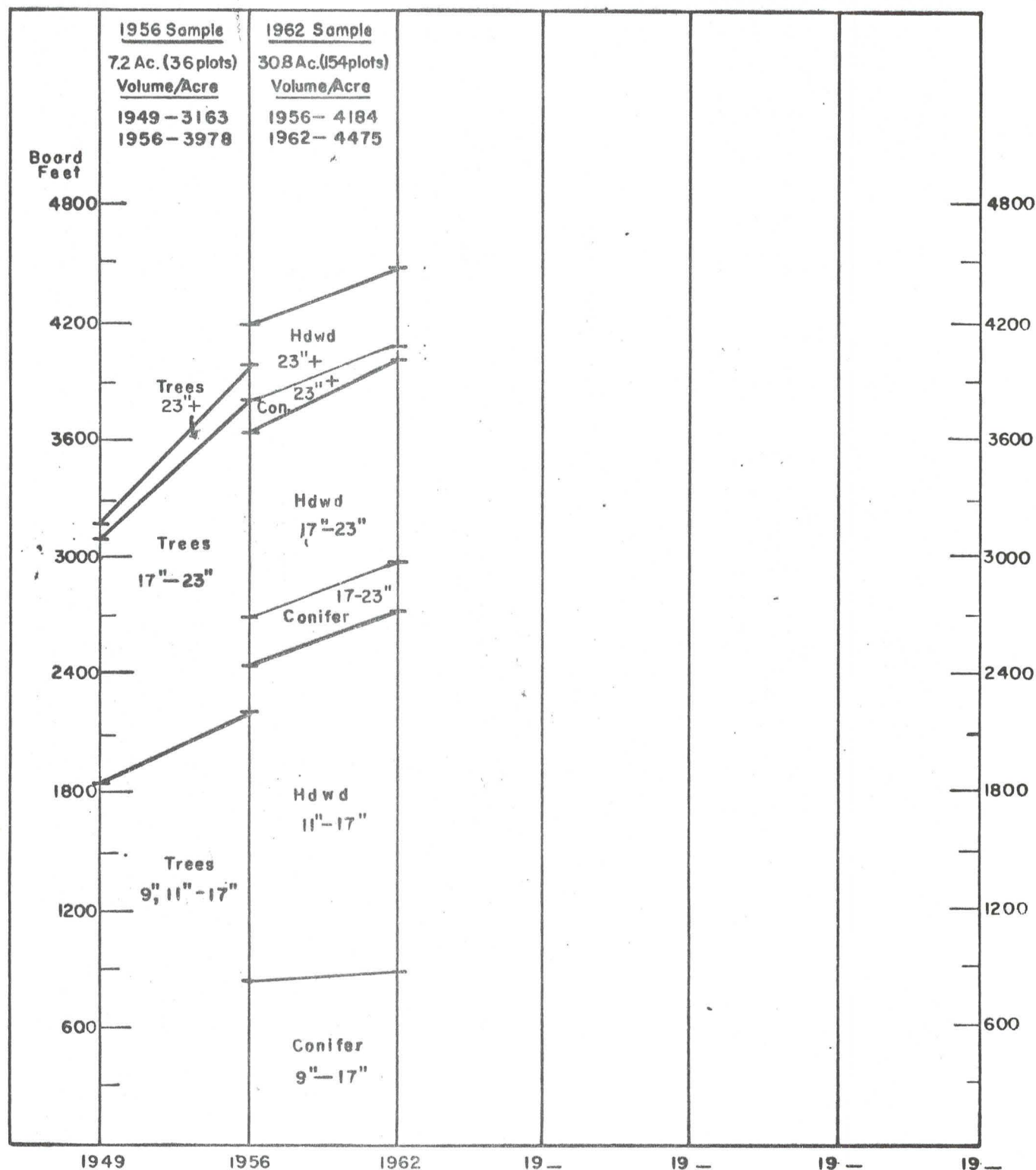


Cull Tree Species	%	Growing Stk.	Cull %	Growing Stk.	Cull %
Conif.	—	1231	13	1165	55
Hdwd.	—	2300	640	2042	1213
Total	16	3531	653	3207	1268

yRotten Cull in yCull increase due
 Growing Stk.-11% or to higher log grades
 357 BF

CUMBERLAND NATIONAL FOREST

Gross Board Foot Volume Per Acre on Remeasured Plots All Live Trees

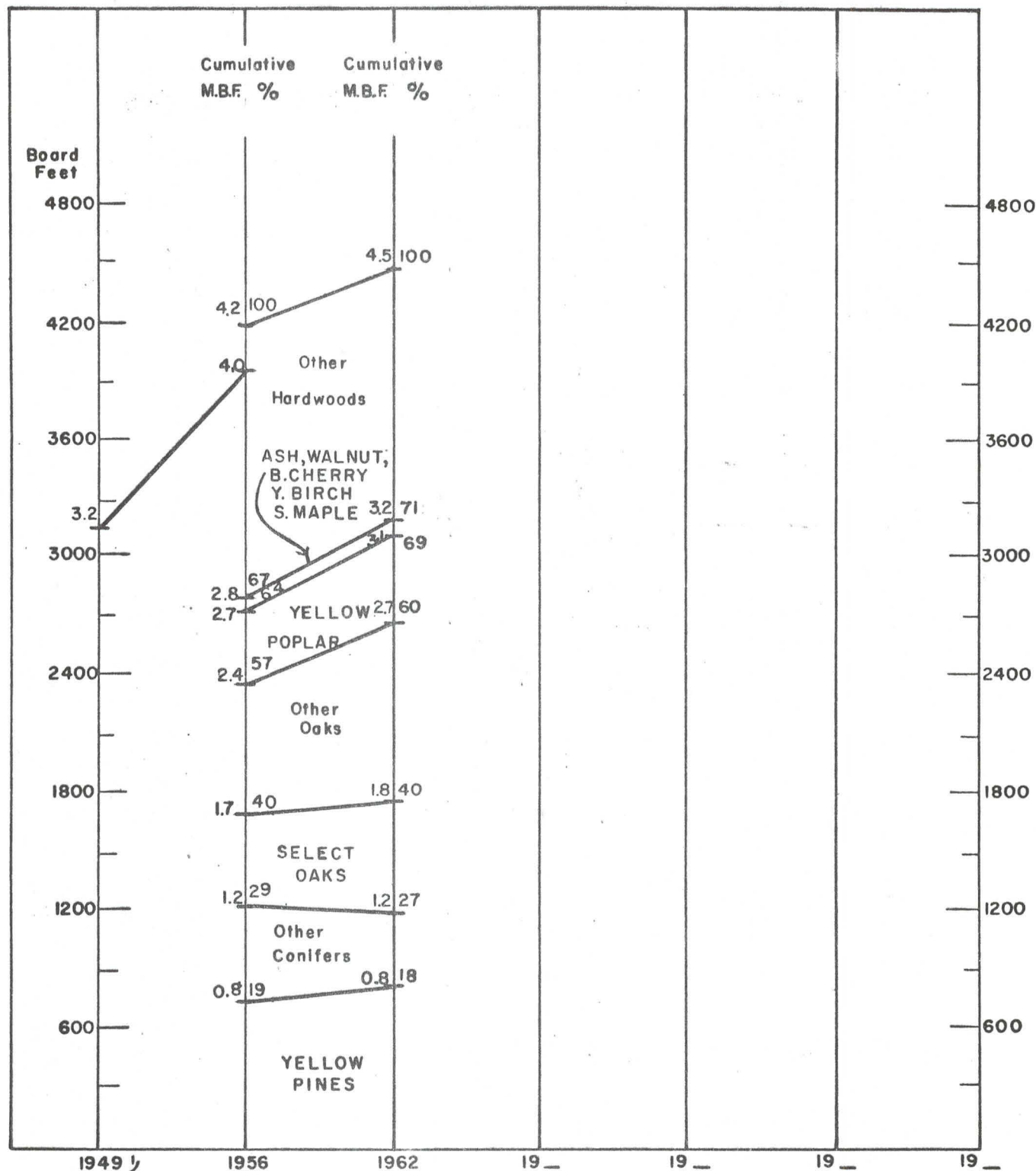


D.B.H.	All Trees		Vol. %		Vol. %	
	Vol.	Con. Hdwd	Con.	Con. Hdwd	Coh.	
9", 11"-17"	1858	843 1618	34	884 1839	32	
17"-23"	1245	236 941	20	266 1038	20	
23"+	60	165 381	30	70 378	19	
Total	3163	1244 2940	30	1220 3255	27	
Vol./Tree	108	95 137 121		85 132 114		

CUMBERLAND NATIONAL FOREST

Gross Board Foot Volume Per Acre of Remeasured Plots

All Live Trees

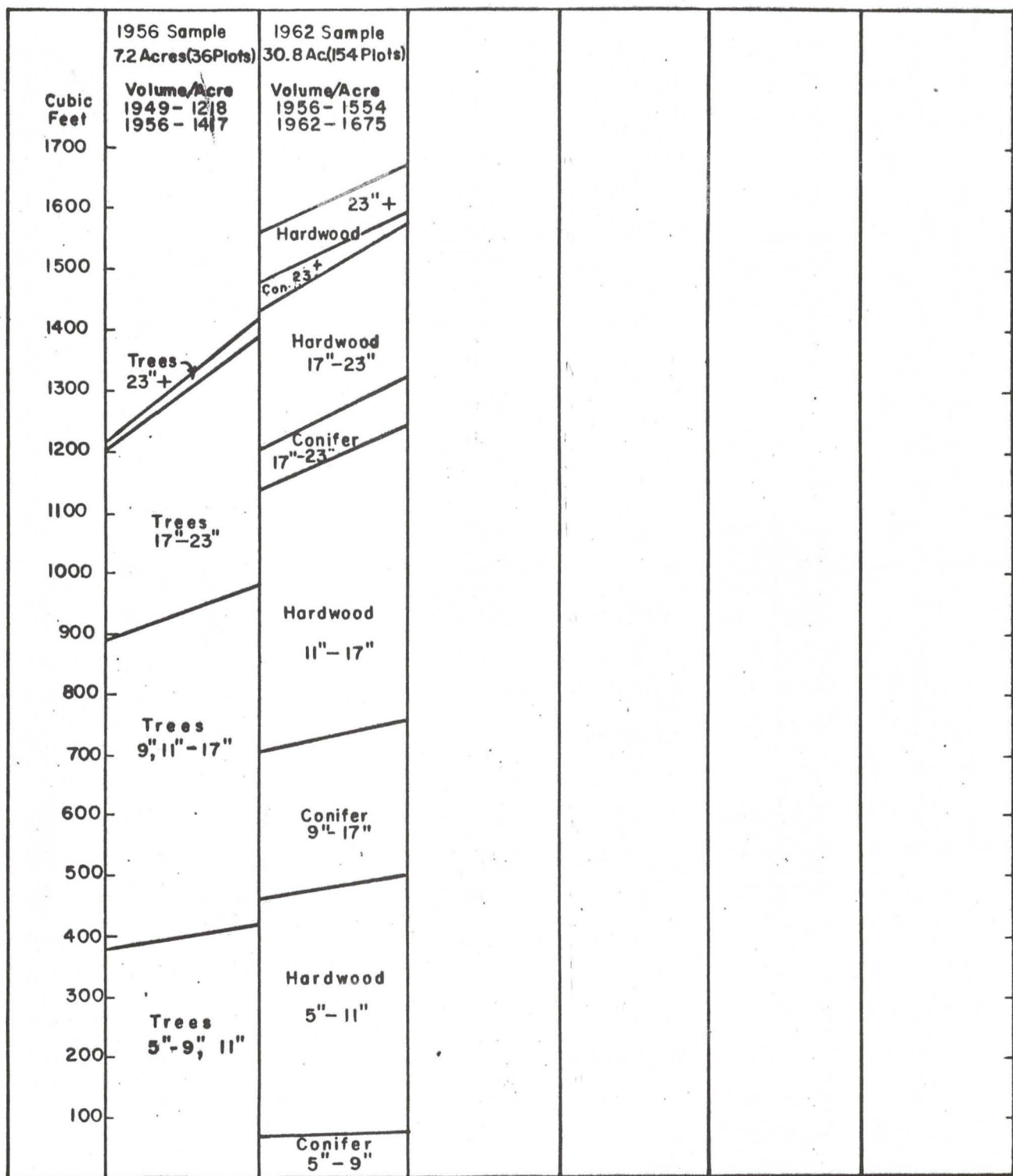


Volume by Species Not Available

GUMBERLAND NATIONAL FOREST

Gross Cubic Foot Volume per Acre on Remeasured Plots

All Live Trees



	Vol.-All	Vol.	%	Vol.	%
D.B.H.	Trees	Con.	Hdwd.	Con.	Hdwd.
5"-9"-11"	377	71	388	15	75
9"-11"-17"	513	247	425	37	260
17"-23"	314	68	228	23	77
23"+	14	47	80	37	20
Total	1218	433	1121	28	432
Vol./Tree	11.7	12.5	12.1	11.7	12.0

CUMBERLAND NATIONAL FOREST

Gross Periodic Annual Cubic Foot Increment on Remeasured Plots

All Live Trees

Net Growth - Summary				
	1949-56	1956-62		
	All Trees	Con.	Hwd.	Total
All Trees	45.5	12.8	35.6	48.4
Mortality	15.2	1.1	8.3	9.4
Net-Live Trees	30.3	11.7	27.3	39.0
Cull Trees	4.8	0.4	8.0	8.4
Net, Gr. Sk.	25.5	11.3	19.3	30.6

1/ 48% or 4.5 cubic feet is in growing stock trees.

